BALLUFF

sensors worldwide

BIS M-62_ Processor Unit

Technical Description, Manual

www.balluff.com

CONTENTS

REFERENCES 1
Conventions 1
Reference Documentation 1
Services and Support 1

REGULATORY AND COMPLIANCE NOTICES 2
Power Supply 2
GENERAL VIEW 3

1 OVERVIEW 11
1.1 Introduction 11
1.2 HF-Series Features 11
1.3 About this Manual 11
1.3.1 Who Should Read This Manual? 12
1.3.2 HEX Notation 12
1.4 Models and Accessories 12
1.5 Balluff RFID Tags 13

2 INSTALLATION 15
2.1 Mechanical Dimensions 15
2.1.1 BIS M-620-068-A01-00-_ _ Serial RS232 Models 15
2.1.2 BIS M-620-067-A01-04-_ _ Subnet16 Models 16
2.1.3 BIS M-626-_ _ Ethernet/IP Models 17
2.1.4 BIS M-623-_ _ DeviceNet Models 18
2.1.5 BIS M-622-_ _ Profibus Models 19
2.1.6 BIS M-628-_ _ PROFINET Models 20
2.2 BIS M-37_ Antenna Mounting 25
2.2.1 Direct Antenna Mounting 25
2.2.2 Remote Antenna Mounting 26
2.2.3 Minimum Mounting Distance Between Adjacent Antennas 27
2.2.4 Antenna to Tag Range 28
2.3 Electrical Connectors 29
2.3.1 RS232 29
2.3.2 RS485 30
2.3.3 Industrial Ethernet IP 31
2.3.4 DeviceNet 32
2.3.5 Profibus 34
2.3.6 Profinet 36
2.3.7 Digital I/O (-12 models) 38
2.4 Power & Wiring 39
2.4.1 Power Requirements 39
2.4.2 Total System Current Consumption 39
2.4.3 Cable Voltage Drop 40
2.4.4 Current Rating for Cables 40
2.5 Installation Guidelines 41
2.5.1 Hardware Requirements 41
2.5.2 Installation Precautions 41
2.6 Typical Layouts and Installation Procedures 42
2.6.1 Installing the BIS M-620-068-A01-00-S_ RS232 42
2.6.2 Installing the BIS M-620-067-A1-04-S_ RS485 43

2.6.3 Installing the BIS M-626-069-A01-06_ Industrial Ethernet (IND) 44
2.6.4 Installing the BIS M-623-071-A01-03-S_ DeviceNet (DNT) 45
2.6.5 Installing the BIS M-622-070-A01-03-ST33 Profibus (PBS) 46
2.6.6 Installing the BIS M-628-075-A01-03-ST34 PROFINET (PNT)....48
2.7 Digital I/O (-12 models) 50
2.7.1 Input....50
2.7.2 Outputs 52
2.7.3 Digital I/O Command Control 56

3 LED INDICATORS 57
3.1 Front Panel LEDs....57
3.1.1 BIS M-620-068-A01-00_ RS232 Models 57
3.1.2 BIS M-620-067-A01-04_ RS485 Models 57
3.1.3 BIS M-626-069-A01-06_ INDUSTRIAL Models....58
3.1.4 BIS M-623-071-A01-03-ST30 DEVICENET Models....58
3.1.5 BIS M-622-070-A01-03-ST33 PROFIBUS Models 59
3.1.6 BIS M-628-075-A01-03-ST34 PROFINET Models 60

4 CONFIGURATION METHODS....61
4.1 Configuration Tag 61
4.1.1 Node ID Configuration Using Configuration Tags....61
4.2 Configuration Tools....62
4.2.1 Configuration Using Balluff Dashboard™ 63
4.2.2 Software Upgrades Using Balluff Dashboard™....65
4.2.3 Creating and Using RFID Macros with C-Macro Builder™ 65
4.3 Command Protocols....69

5 ETHERNET/IP INTERFACE....71
5.1 Ethernet/IP Configuration Overview 72
5.2 HTTP Server & OnDemand PLC Support 72
5.3 HTTP Server and OnDemand Utilities....73
5.4 IP Configuration via HTTP Server 74
5.5 OnDemand Configuration for Ethernet/IP....76
5.6 Configuring PLC Controller Tags 79
5.7 Checking OnDemand Status....81
5.8 Verifying Data Exchange with RSLogix 5000 82
5.8.1 Ethernet/IP Handshaking 82
5.8.2 Ethernet/IP Handshaking Example....83
5.9 Ethernet/IP: Object Model 84
5.9.1 Ethernet/IP Required Objects....85
5.9.2 EtherNet/IP: Vendor Specific Objects....89
BIS M-626 Consume Data Object (0x64 - 32 Instances) 89
5.9.3 Application Object (0x67 _ 10 Instances)....92

6 MODBUS TCP INTERFACE....95
6.1 Modbus TCP Overview 95
6.2 Modbus TCP Configuration via HTTP Server....95
6.2.1 Modbus TCP - Command Packet Structure 98
6.2.2 Modbus TCP - Response Packet Structure....98
6.2.3 Modbus TCP - Mapping for Node 33....99
6.3 Modbus TCP - Handshaking 100
6.3.1 Modbus TCP - Host/BIS M-626_ Handshaking 101
6.3.2 Modbus TCP - Handshaking Example 101

7 STANDARD TCP/IP INTERFACE 103

7.1 Standard TCP/IP Overview 103
7.2 Standard TCP/IP - IP Configuration via HTTP Server 103
7.3 Standard TCP/IP - Command & Response Examples 106
7.3.1 Standard TCP/IP - Command Structure Example 107
7.3.2 Standard TCP/IP - Response Structure Example 107

8 DEVICENET INTERFACE 108
8.1 DeviceNet Overview 108
8.2 DeviceNet Configuration 108
8.2.1 Importing the Controller.EDS File 108
8.2.2 Configuring Controller and PLC DeviceNet Communications 109
8.2.3 Configuring Data Rate and Node Address 114
8.2.4 DeviceNet - Exchanging Data and Handshaking 115
8.2.5 DeviceNet - Handshaking Example 116

9 PROFIBUS INTERFACE 119
9.1 Profibus Overview 119
9.2 Profibus-DP 119
9.3 Data Exchange 120
9.4 Protocol Implementation 121
9.4.1 Definitions 121
9.4.2 Control Field 122
9.4.3 SAP Field 125
9.4.4 Length Field 125
9.4.5 Application Data Buffer 126
9.5 Examples of Profibus Command/Response Mechanism 126
9.5.1 Example 1: Normal Command/Response Sequence 128
9.5.2 Example 2: Unsolicited Responses (Continuous Read Mode) 138
9.5.3 Example 3: Fragmentation of Responses 142
9.5.4 Example 4: Fragmentation of Commands 151
9.5.5 Example 5: Resynchronization 162

10 PROFINET INTERFACE 167
10.1 Profinet Overview 167
10.2 Profinet IO 167
10.3 Data Exchange 168
10.4 Protocol Implementation 169
10.4.1 Definitions 169
10.4.2 Control Field 170
10.4.3 SAP Field 173
10.4.4 Length Field 173
10.4.5 Application Data Buffer 174
10.5 Examples of Profnet Command/Response Mechanism 174

11 TECHNICAL FEATURES 178
11.1 BIS M-62_ Processor units 178
11.2 BIS M-37_ Antennas 179

REFERENCES

CONVENTIONS

This manual uses the following conventions:

“User” or “Operator” refers to anyone using a BIS M-62_ Processor.

“Device” refers to the BIS M-62_ Processor.

“You” refers to the System Administrator or Technical Support person using this manual to install, mount, operate, maintain or troubleshoot a BIS M-62_ Processor.

BIS M-41_ , BIS M-62_ and BIS U-62_ RFID Processors are referred to as Processors, or just “the Processor ”.

In addition, the terms “Subnet Node Number”, “Node ID” and “Processor ID” are used interchangeably.

BIS M-620-068_ correspond to the old name HF-CNTL-232_ unit
BIS M-620-067_ correspond to the old name HF-CNTL-485_ unit
BIS M-622-068_ correspond to the old name HF-CNTL-PBS_ unit
BIS M-623-071_ correspond to the old name HF-CNTL-DNT_ unit
BIS M-626-069_ correspond to the old name HF-CNTL-IND_ unit
BIS M-628-075_ correspond to the old name HF-CNTL-PNT_ unit

REFERENCE DOCUMENTATION

The documentation related to the BIS M-62_ Processor Unit management is available on the specific product page at the website:

www.balluff.com

SERVICES AND SUPPORT

Balluff provides several services as well as technical support through its website. Log on to **www.balluff.com** and click on the links indicated for further information including:

- **PRODUCTS**
  Search through the links to arrive at your product page which describes specific Info, Features, Applications, Models, Accessories, and Downloads including:
  - **Dashboard™**: a Windows-based utility program, which allows system testing, monitoring, and configuration using a PC. It provides Serial (RS232 or USB) and Ethernet interface configuration.
  - **C-Macro Builder™**: an easy to use GUI-driven utility for Windows. This software tool allows users with minimal programming experience to “build” their own macro programs (which are stored internally on and executed directly by RFID Processors).

REGULATORY AND COMPLIANCE NOTICES

This product is intended to be installed by Qualified Personnel only.

This product must not be used in explosive environments.

Only connect Ethernet and data port connections to a network which has routing only within the plant or building and no routing outside the plant or building.

CE

POWER SUPPLY

This product is intended to be installed by Qualified Personnel only.

This device is intended to be supplied by a UL Listed or CSA Certified Power Unit with «Class 2» or LPS power source.

GENERAL VIEW

RS232 Models

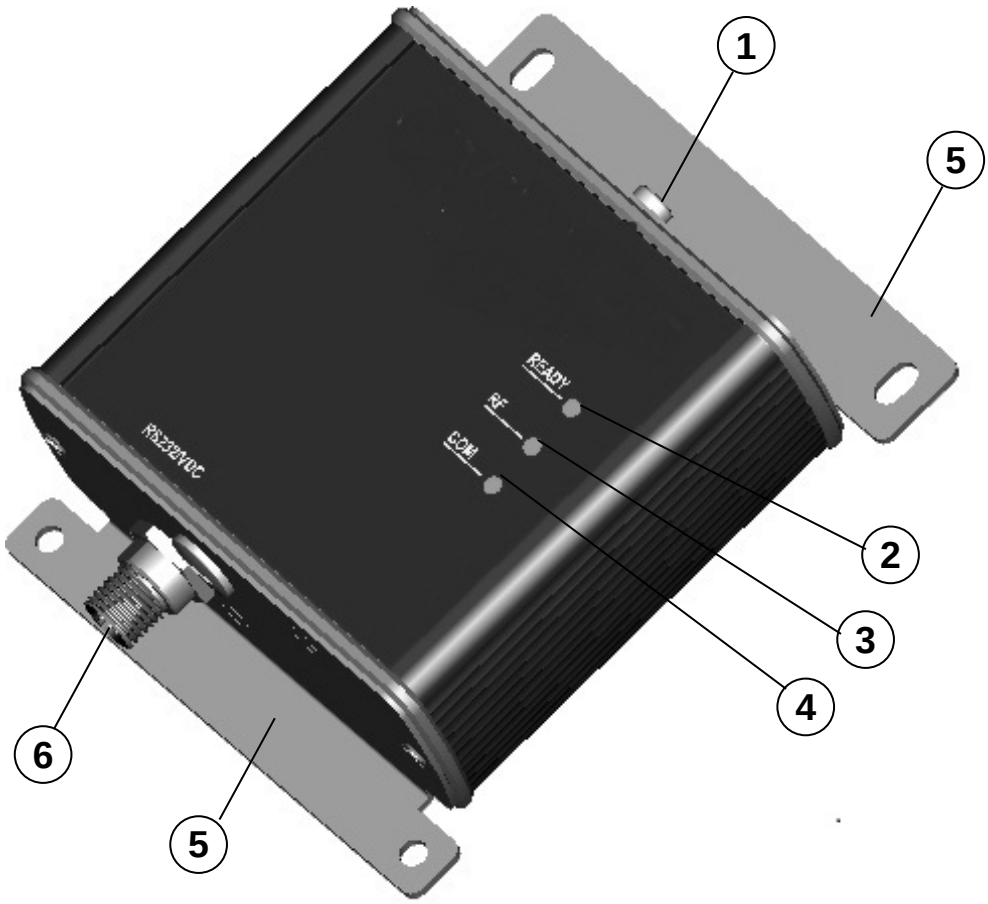


Figure A

1. HF Antenna Connector
2. Ready LED
3. RF LED
4. COM LED
5. Mounting Bracket
6. Host (RS232) and Power Connector

RS485 Models

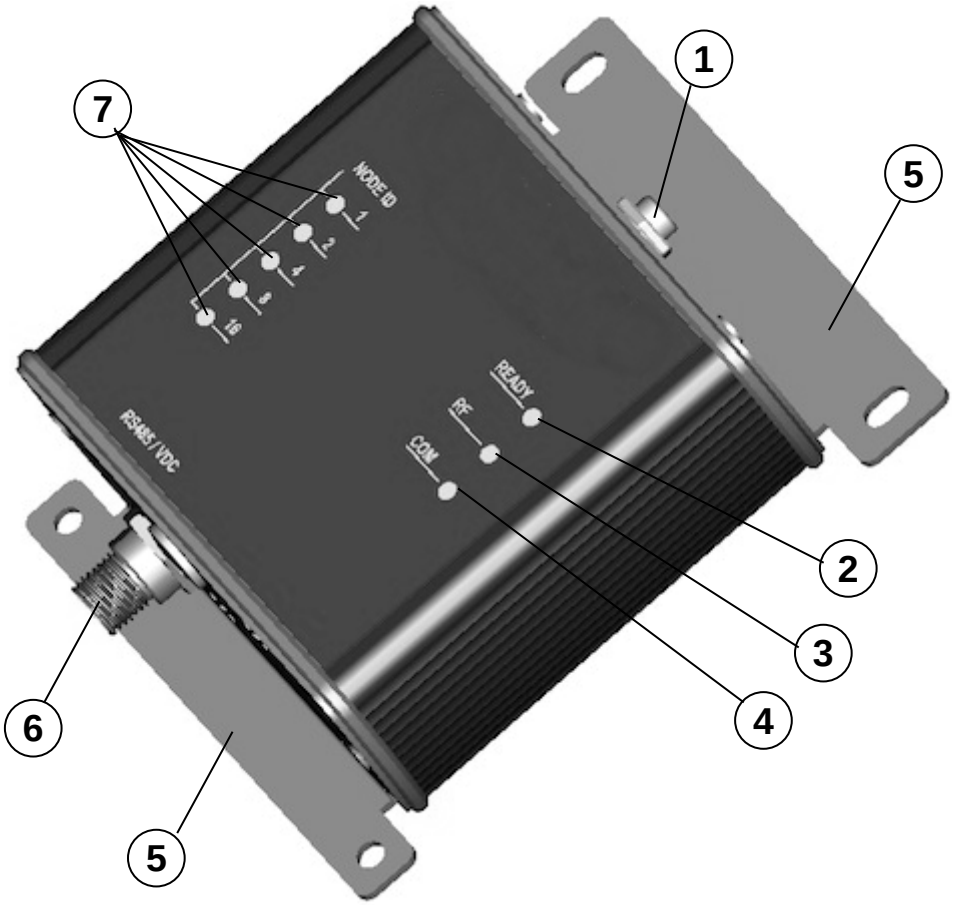


Figure B

1. HF Antenna Connector
2. Ready LED
3. RF LED
4. COM LED
5. Mounting Bracket
6. Host (RS485) and Power Connector
7. Node ID LEDs

IND Models

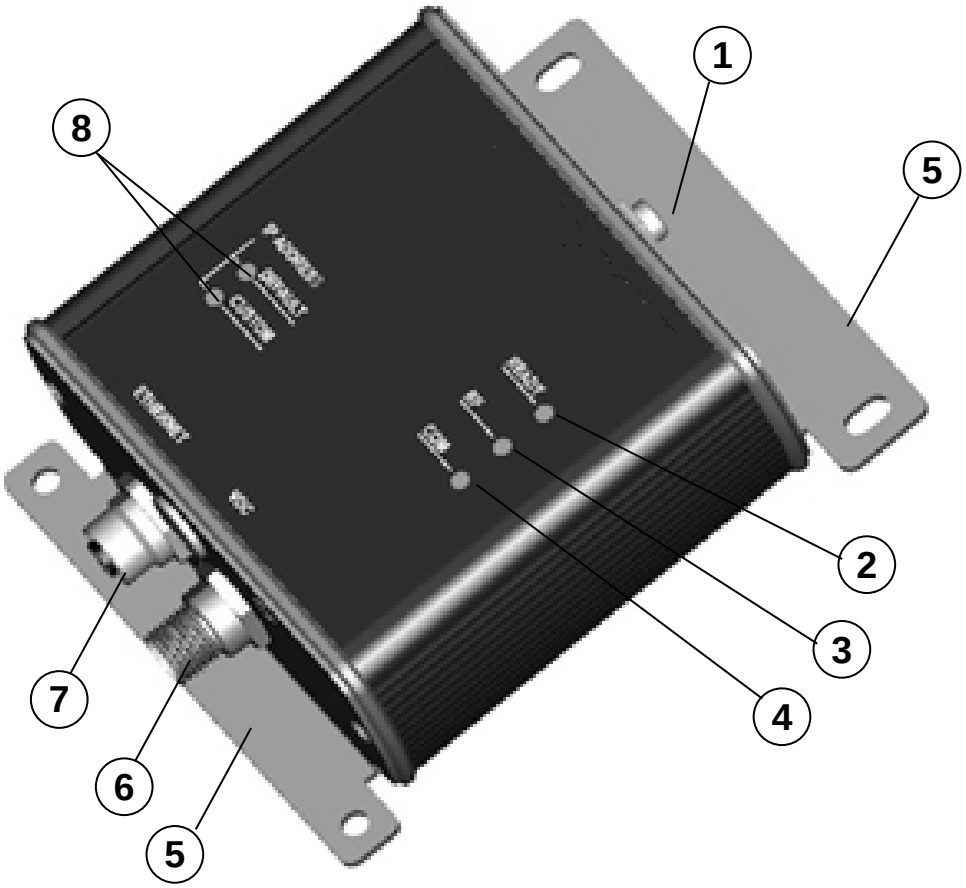


Figure C

1. HF Antenna Connector
2. Ready LED
3. RF LED
4. COM LED
5. Mounting Bracket
6. Power Connector
7. Host (Ethernet) Connector
8. IP Address Status LEDs

DNT Models

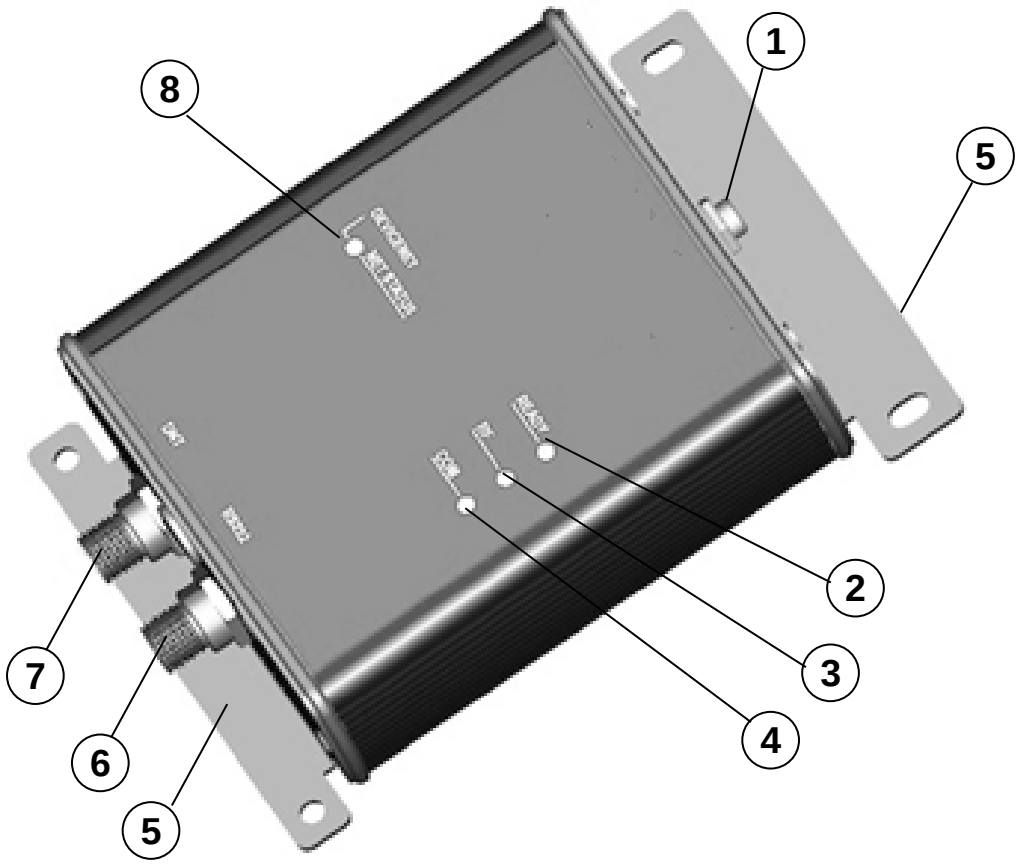


Figure D

1. HF Antenna Connector
2. Ready LED
3. RF LED
4. COM LED
5. Mounting Bracket
6. RS232 Configuration Connector
7. Host (DeviceNet) and Power Connector
8. DeviceNet Status LED

PBS Models

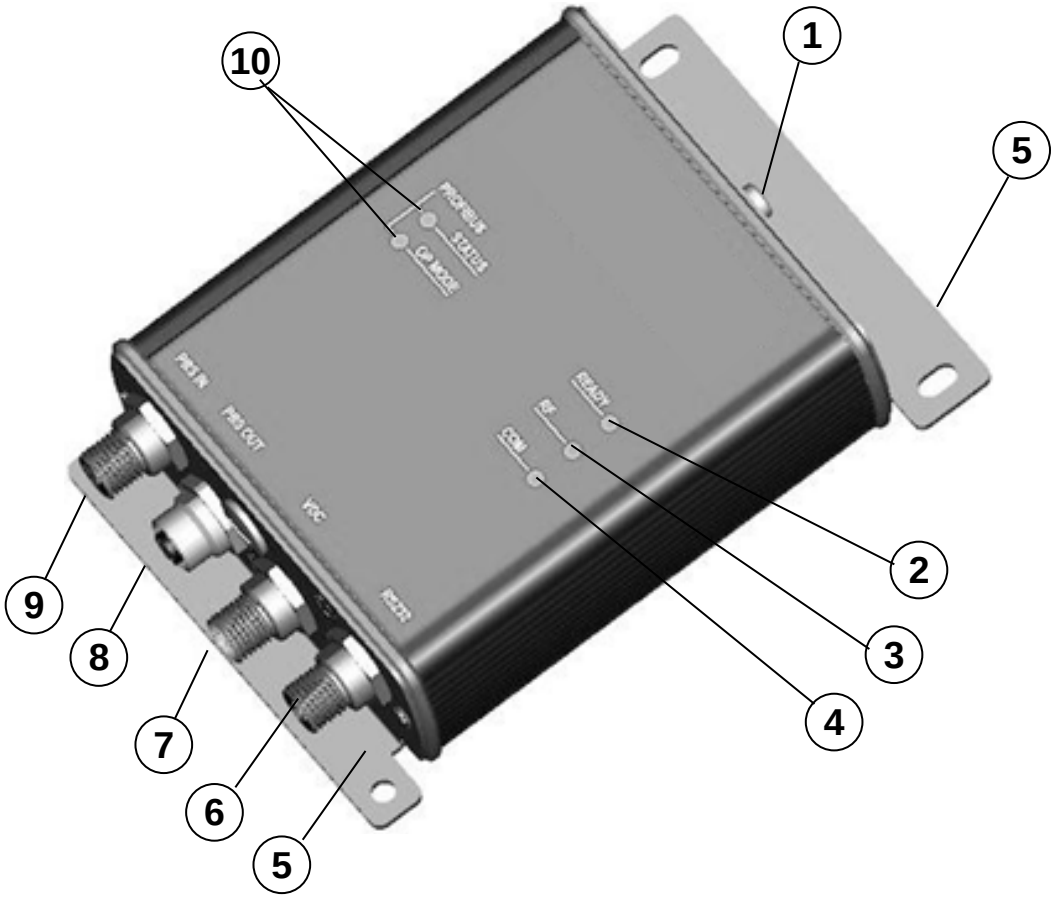


Figure E

1. HF Antenna Connector
2. Ready LED
3. RF LED
4. COM LED
5. Mounting Bracket
6. RS232 Configuration Connector
7. Power Connector
8. Host (Profibus Out) Connector
9. Host (Profibus In) Connector
10. Profibus Status LEDs

PNT Models

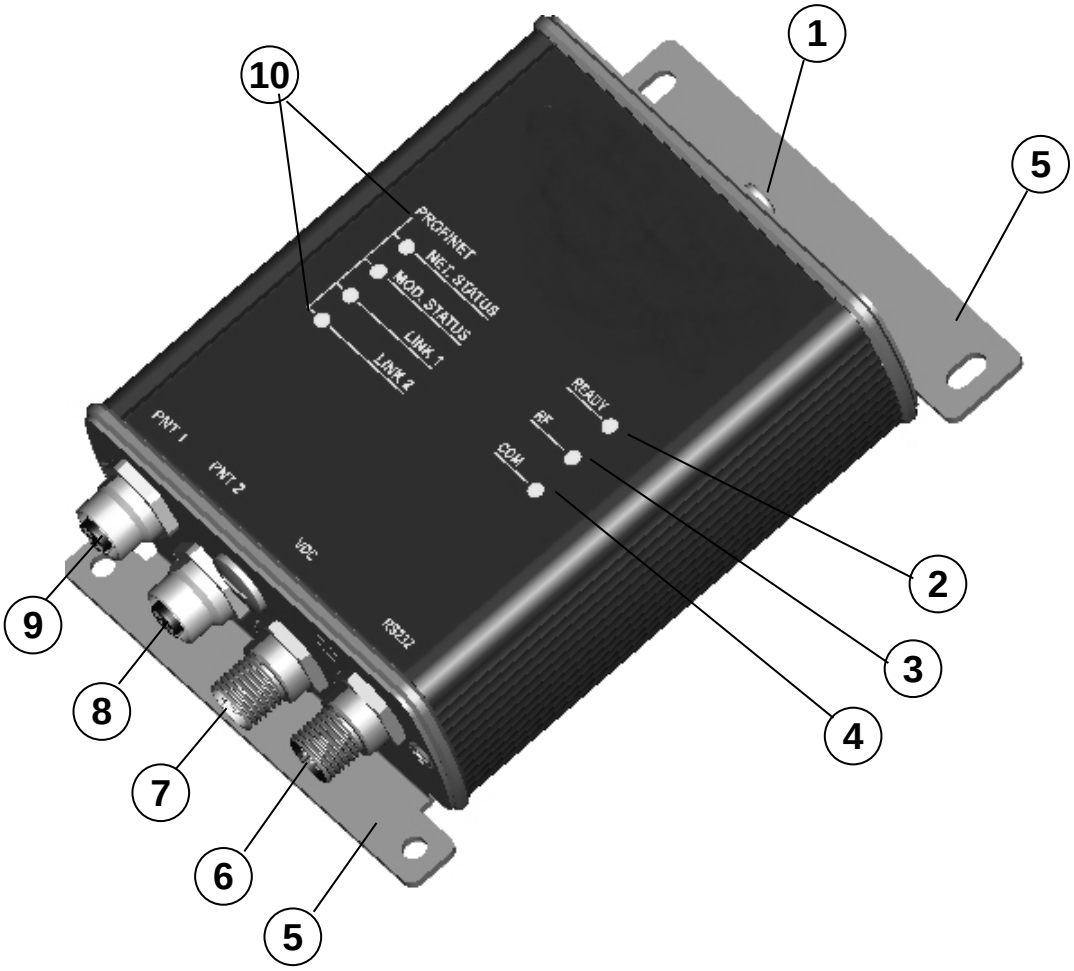


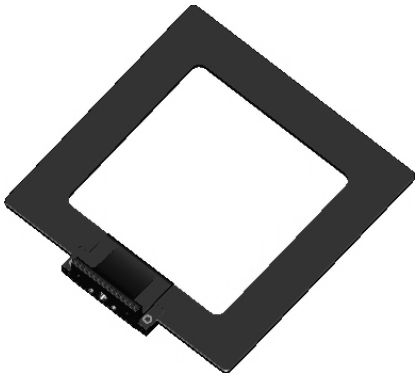
Figure F

1. HF Antenna Connector
2. Ready LED
3. RF LED
4. COM LED
5. Mounting Bracket
6. RS232 Configuration Connector
7. Power Connector
8. Profinet 2 Connector
9. Profinet 1 Connector
10. Profinet Status LEDs

BIS M-371-000-A01

BIS M-372-000-A01

BIS M-373-000-A01



BIS M-370-000-A02

Figure G

1 OVERVIEW

1.1 INTRODUCTION

Welcome to the **BIS M-62_ Processor Manual**. This manual will assist you in the installation, configuration and operation of the BIS M-62_ family of processor units.

The BIS M-62_ is a complete line of feature-rich, passive, high frequency, read/write Radio-Frequency Identification devices that provide RFID data collection and control solutions to shop floor, item-level tracking and material handling applications. BIS M-62_ processor units are designed to be compact, rugged and reliable, in order to meet and exceed the requirements of the industrial industry. For an overview of RFID operating principles and tags see Appendix **Fehler! Verweisquelle konnte nicht gefunden werden.**.

1.2 HF-SERIES FEATURES

- High performance, industrial, multi-protocol RFID processor units
- Available support for multiple communication protocols: Subnet16™, standard TCP/IP, Ethernet/IP, MODBUS TCP, Profibus-DP-V1 and Profinet IO
- Supports multiple interface connections: RS232, RS485, Ethernet, DeviceNet, Profibus; Profinet
- Reads/Writes ISO 14443A and ISO 15693 compliant RFID tags
- Compatible with BIS m-1xx Series RFID tags from Balluff
- Supports Balluff's ABx Fast & CBx RFID command protocols
- Operates at the internationally recognized ISM frequency of 13.56 MHz
- Housed in rugged IP65 rated enclosure
- LED status indicators display READY status, COM activity, RF activity, and depending on the model, Subnet16 Node ID, DeviceNet, Profibus or Profinet network status
- Auto configurable and software programmable, contains flash memory for firmware upgrades and internal configuration storage.

1.3 ABOUT THIS MANUAL

This manual provides guidelines and instructions for installing, configuring and operating HF-Series Processor units.

This document does NOT include explicit details regarding the HF-Series Processor units commands. Specific RFID command related information such as: the process of issuing commands from a host PC or Programmable Logic Processor units (PLC) to the HF-Series Processor units is available in the CBx Command Protocol – Processor manual , which is available at www.balluff.com.

1.3.1 Who Should Read This Manual?

This manual should be read by those who will be installing, configuring and operating the Processor units. This may include the following people:

- Hardware Installers
- System Integrators
- Project Managers
- IT Personnel
- System and Database Administrators
- Software Application Engineers
- Service and Maintenance Engineers

1.3.2 HEX Notation

Throughout this manual, numbers expressed in Hexadecimal notation are prefaced with "**0x**". For example, the number "10" in decimal is expressed as "0x0A" in hexadecimal.

1.4 MODELS AND ACCESSORIES

Balluff designs, manufactures and distributes a wide range of RFID equipment including Processor units, network interface modules (Gateways and Hubs), RFID tags and the cables needed to make it all work.

Listed here are the products and accessories relative to the HF-Series processor units. For a complete list of products and accessories relative to the Subnet16™ Gateway see the Gateway Processor manual.

To purchase any of the Balluff products listed below contact your Balluff distributor or visit our Web site: http://www.balluff.com.

Name	Description	Order Code
BIS M-62_ Processor units		
BIS M-620-068-A01-00-S115	BIS M-62_ Processor units - RS232	BIS00ZJ
BIS M-620-068-A01-00-ST29	BIS M-62_ Processor units - RS232 w I/O	BIS00ZH
BIS M-620-067-A01-04-S92	BIS M-62_ Processor units - RS485 Subnet16™	BIS00ZL
BIS M-620-067-A01-04-ST30	BIS M-62_ Processor units - RS485 Subnet16™ w I/O	BIS00ZK
BIS M-626-069-A01-06-ST31	BIS M-62_ Processor units - Industrial Ethernet	BIS00ZC
BIS M-626-069-A01-06-ST32	BIS M-62_ Processor units - Industrial Ethernet w I/O	BIS00ZA
BIS M-623-071-A01-03-ST30	BIS M-62_ Processor units - DeviceNet	BIS00ZE
BIS M-622-070-A01-03-ST33	BIS M-62_ Processor units - Profibus	BIS00ZF
BIS M-628-075-A01-03-ST34	BIS M-62_ Processor units - Profinet	
HF-Series Antennas		
BIS M-370-000-A02	BIS M-37_ Antenna 7 x 50 cm	BIS00WN
BIS M-371-000-A01	BIS M-37_ Antenna 10 x 10 cm	BIS00WM
BIS M-372-000-A01	BIS M-37_ Antenna 20 x 20 cm	BIS00WL
BIS M-373-000-A01	BIS M-37_ Antenna 30 x 30 cm	BIS00WK
BIS M-500-PVC-07-A01-/02	BIS M-37_ Remote Antenna kit 7 m	BIS00WJ

Name	Description	Order Code
Cables & Connectors		
BCC M418-D279-BF-701-PS0825-020	RS232 Cable: M12, DB9-pin, PS wires	BCC0ETJ
BCC M415-M415-3A-330-PS85N6-003	Cable: M12, 5-pin, Male/Female, ThinNet, 0.3 m	BCC0ERY
BCC M415-M415-3A-330-PS85N6-010	Cable: M12, 5-pin, Male/Female, ThinNet, 1 m	BCC0ERZ
BCC M415-M415-3A-330-PS85N6-020	Cable: M12, 5-pin, Male/Female, ThinNet, 2 m	BCC0ET0
BCC M415-M415-3A-330-PS85N6-050	Cable: M12, 5-pin, Male/Female, ThinNet, 5 m	BCC0ET1
BCC M415-M415-6A-330-PS85N6-002	Cable: M12, 5-pin, Male/Male, ThinNet, 0.2 m (Gateway to Drop-T)	BCC0ET2
BCC M415-M415-6A-330-PS85N6-010	Cable: M12, 5-pin, Male/Male, ThinNet, 1 m (Gateway to Drop-T)	BCC0ET3
BCC M415-M415-6A-330-PS85N6-020	Cable: M12, 5-pin, Male/Male, ThinNet 2 m (Gateway to Drop-T)	BCC0ET4
BCC A315-A315-30-330-PS85N4-020	Cable: 7/8–16, 5-pin, Male/Female, ThickNet, 2 m	BCC095A
BCC A315-A315-30-330-PS85N4-050	Cable: 7/8–16, 5-pin, Male/Female, ThickNet, 5 m	BCC095F
BCC M415-0000-1A-030-PS85N6-020	Cable: M12, 5-pin, Female / Bare Wires, ThinNet, 2 m	BCC0ETA
BCC M415-0000-1A-030-PS85N6-050	Cable: M12, 5-pin, Female / Bare Wires, ThinNet, 5 m	BCC0ETC
BCC A315-0000-10-030-PS85N4-050	Cable: 7/8-16, 5-pin, Female / Bare Wires, 5M	BCC096Y
BCC A315-0000-10-030-PS85N6-050	Cable: M12, 5-pin, Male / Bare Wires, ThinNet, 2M	BCC08WT
BCC M414-E834-8G-672-ES64N8-050	Industrial Ethernet Cable: M12, RJ45 5 m	BCC0CT1
Subnet16™ Ts, Terminators, Connectors		
BDN T-DTE-AD-01	Drop-T Connector: 5-pin, 7/8-16 F / M12 F / 7/8-16 M (ThickNet to ThinNet)	BCC07WZ
BDN T-DTN-DD-01	Drop-T Connector: M12, 5-pin, F/F/M (ThinNet to ThinNet)	BCC07WR
BCC M435-0000-1A-000-41X575-000	Field Mountable Connector: M12, 5-pin, Female, Straight	BCC06ZF
BCC A315-0000-2A-R04	Termination Resistor Plug: 7/8-16, 5-pin, Male, (ThickNet)	BCC0A09
BCC M415-0000-2A-R04	Termination Resistor Plug: M12, 5-pin, Male, (ThinNet)	BCC09MR
BCC M438-0000-1A-000-51X850-000	RS232 Connector: M12, 8-pin, Female	BCC0A03
BCC A315-0000-1A-R04	Plug: Termination Resistor, M12, 5-pin, Female (ThinNet)	BCC0A0A
BCC M415-0000-1A-R04	Plug: Termination Resistor, 7/8-16, 5-pin, Female (ThickNet)	BCC0A08
BCC A335-0000-10-000-61X5A5-000	Field Mountable Connector: 7/8-16, 5-pin, Female, Straight	BCC070F
BDN T-DTE-AA-01	T Connector: 7/8-16/5P M/F/F (ThickNet to ThickNet)	BCC07WP

1.5 BALLUFF RFID TAGS

Balluff designs and manufactures several lines of RFID tags.

BIS M-13_ passive read/write RFID tags are especially suited for Balluff HF RFID Processor.

Tag Mounting Kits are also available.

2 INSTALLATION

2.1 MECHANICAL DIMENSIONS

2.1.1 BIS M-620-068-A01-00-_ _ Serial RS232 Models

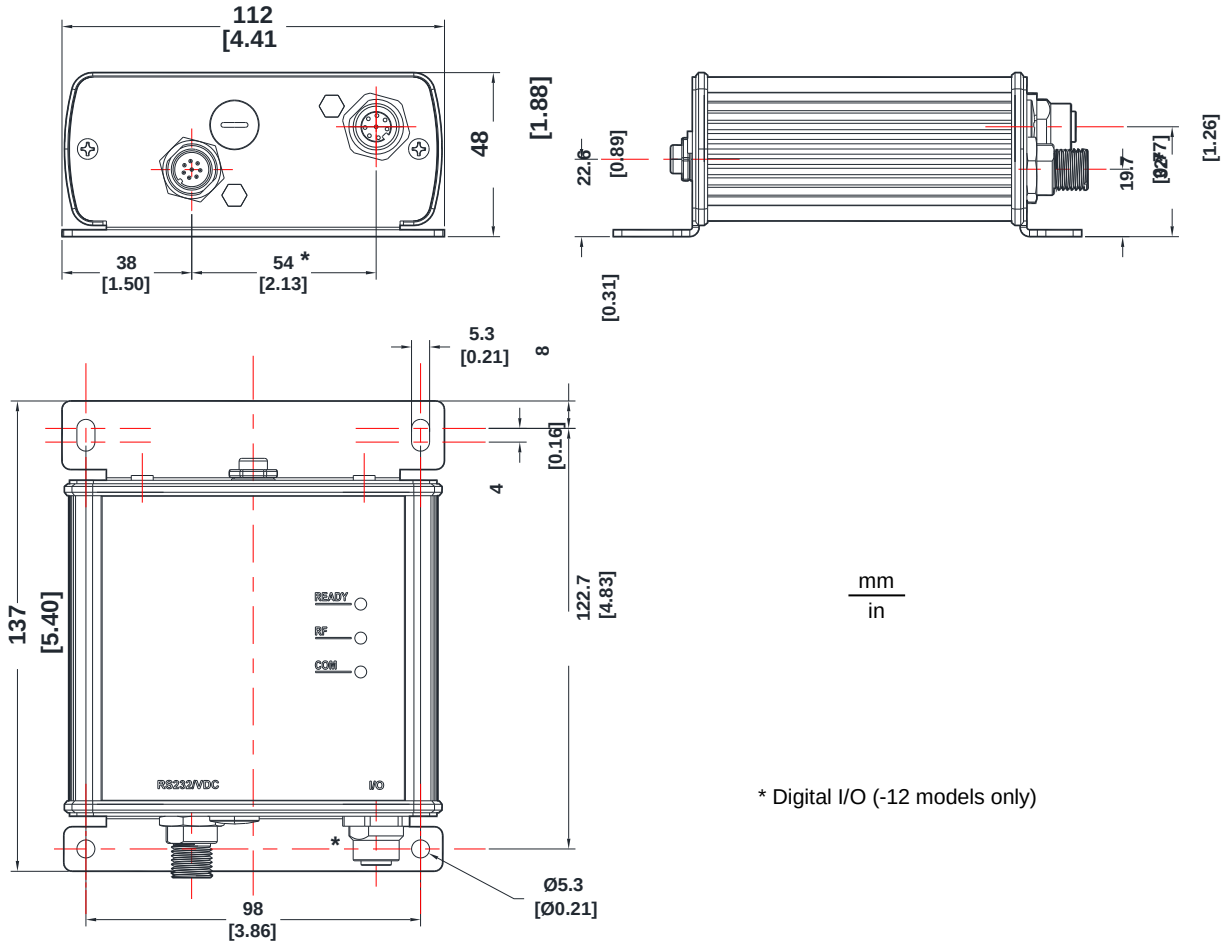


Figure 1 - BIS M-620-068-A01-00-_ _ Dimensions

2.1.2 BIS M-620-067-A01-04-_ _ Subnet16 Models

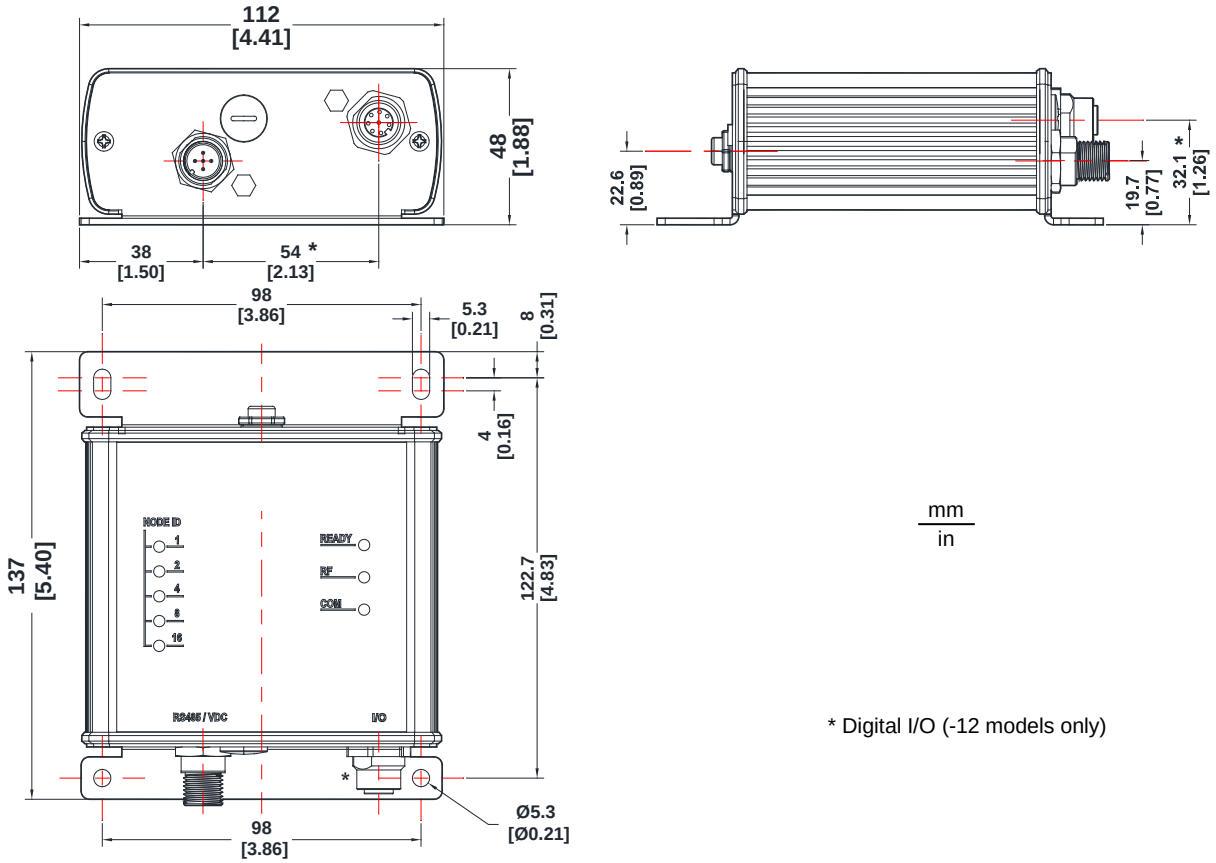


Figure 2 - BIS M-620-067-A01-04-_ _ Dimensions

2.1.3 BIS M-626-_ _ Ethernet/IP Models

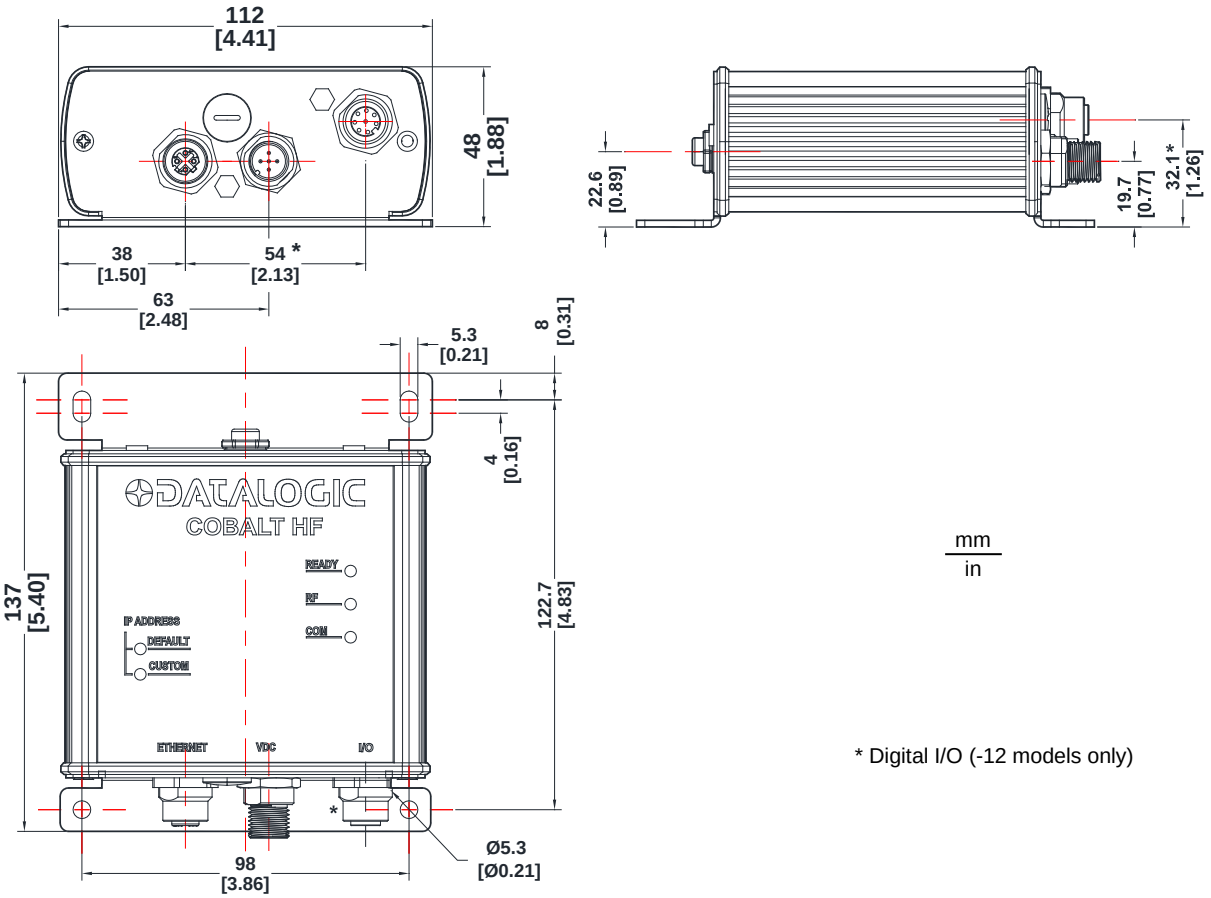


Figure 3 - BIS M-626-_ _ Dimensions

2.1.4 BIS M-623-_ _ DeviceNet Models

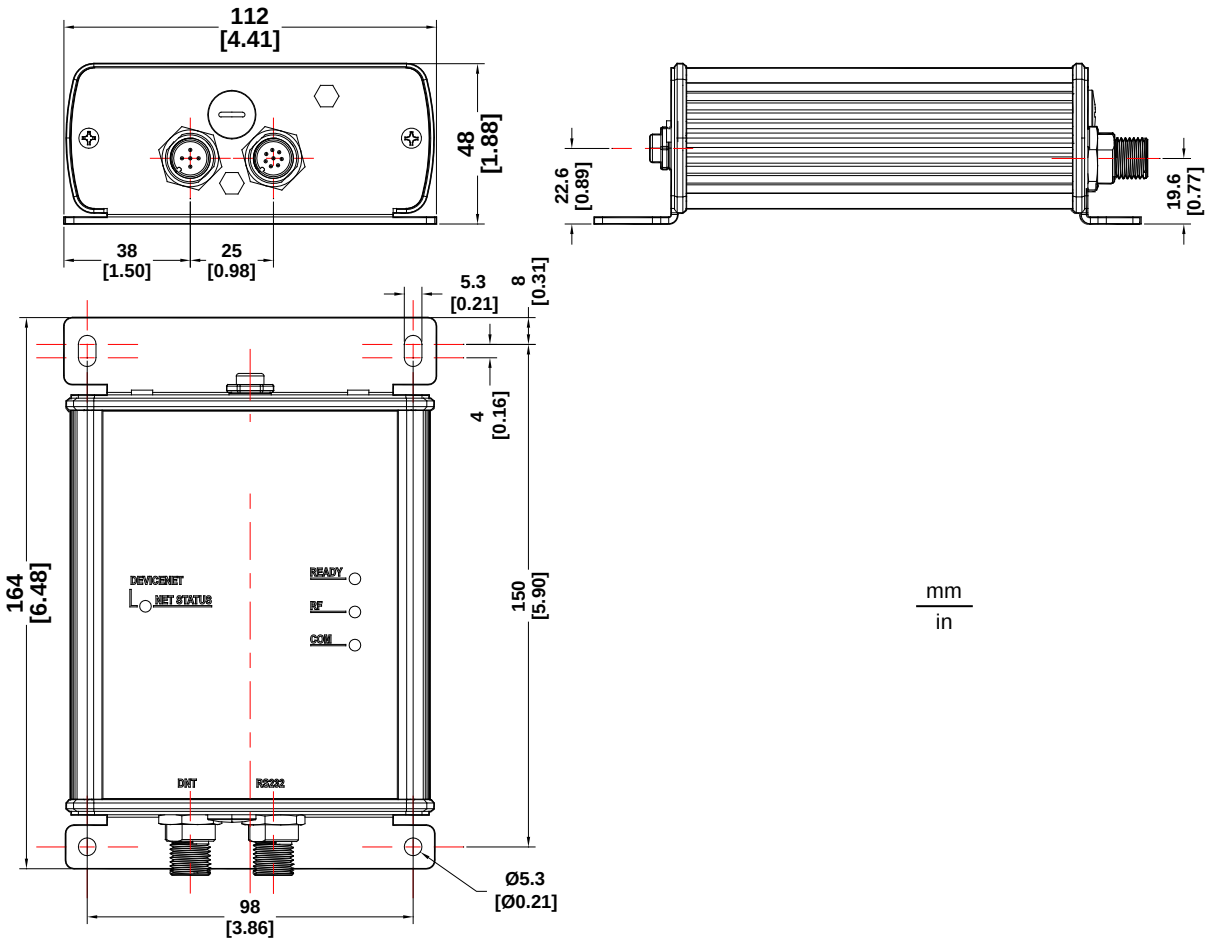


Figure 4 - M-623-_ _ Dimensions

2.1.5 BIS M-622-_ _ Profibus Models

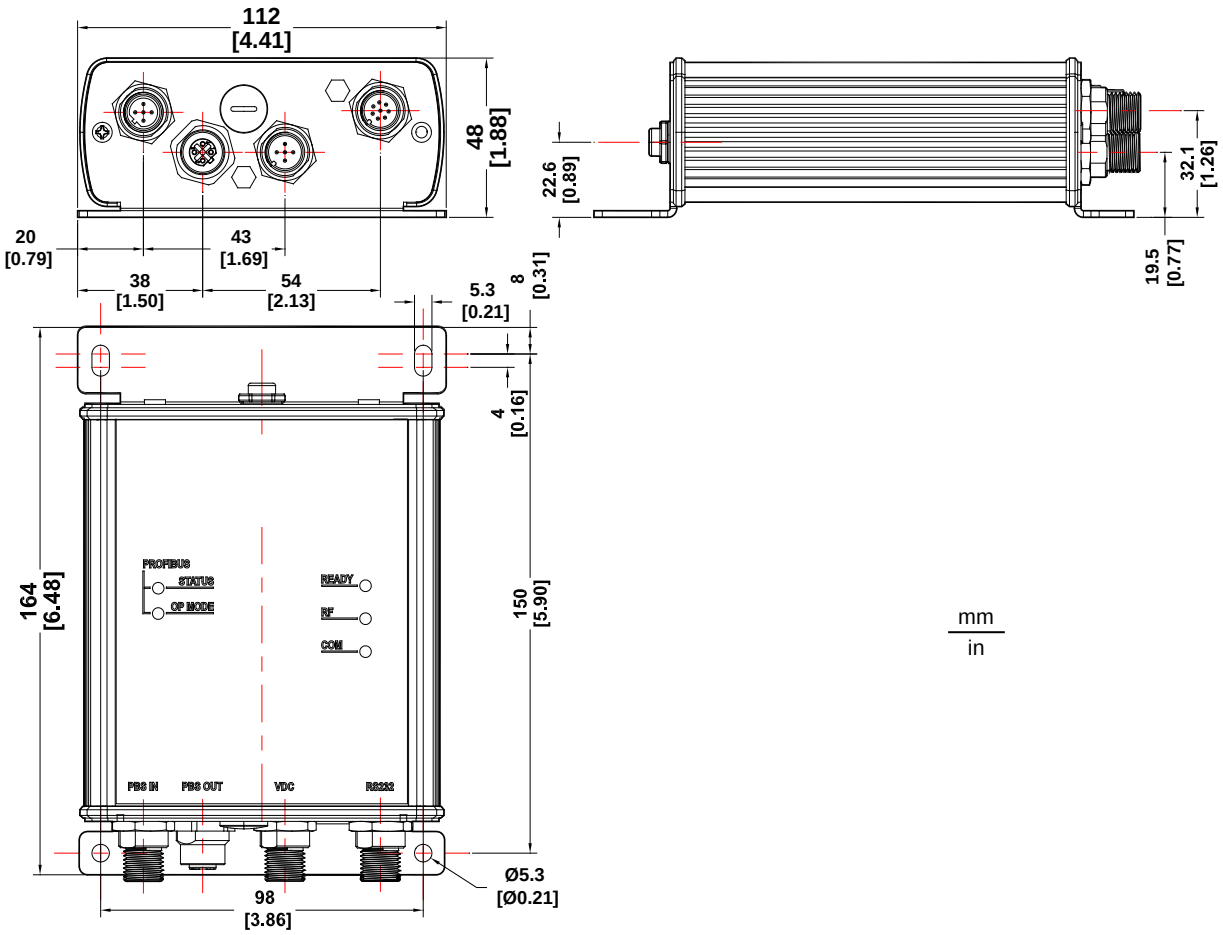


Figure 5 - BIS M-622-_ _ Dimensions

2.1.6 BIS M-628-_ _ PROFINET Models

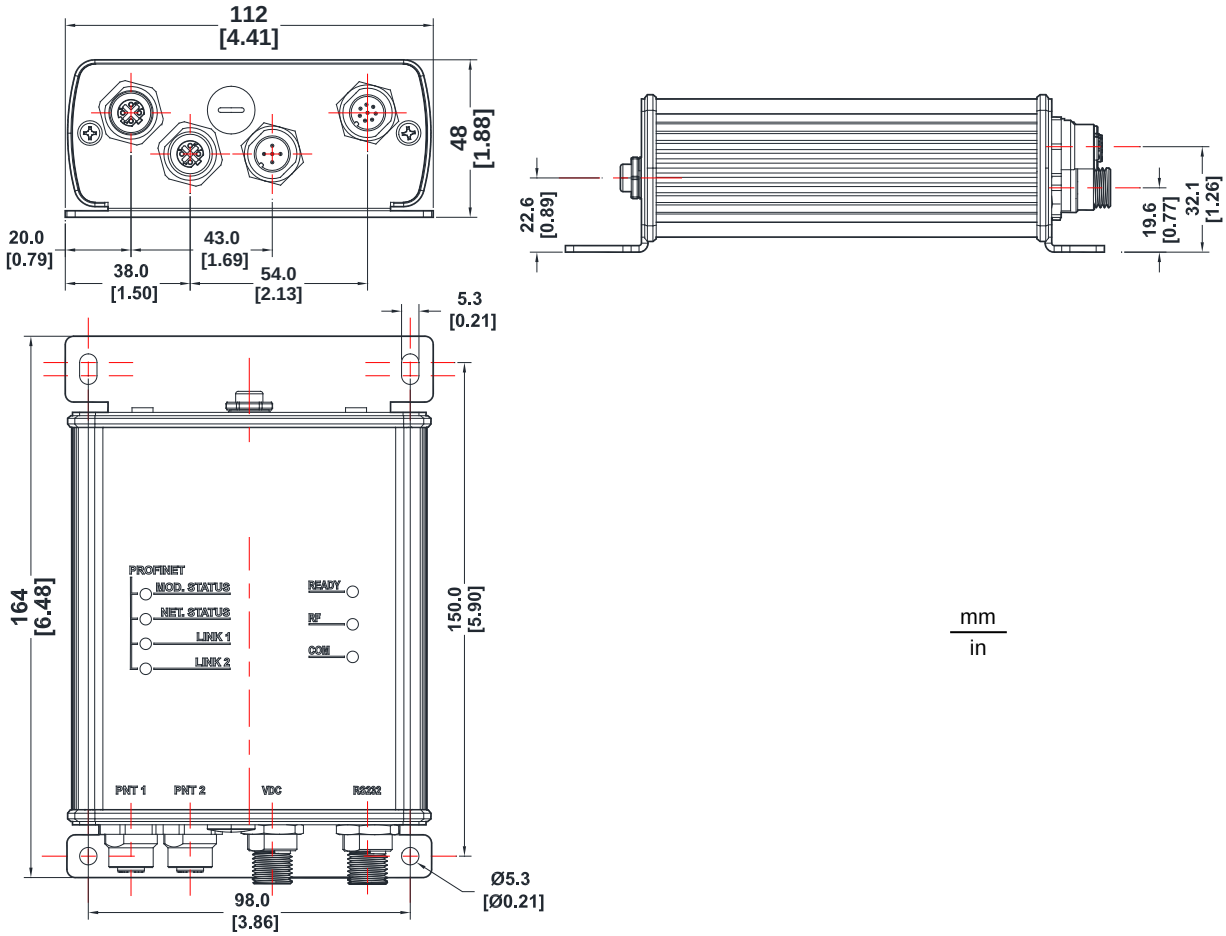


Figure 6 - BIS M-628-_ _ Dimensions

BIS M-371-000-A01

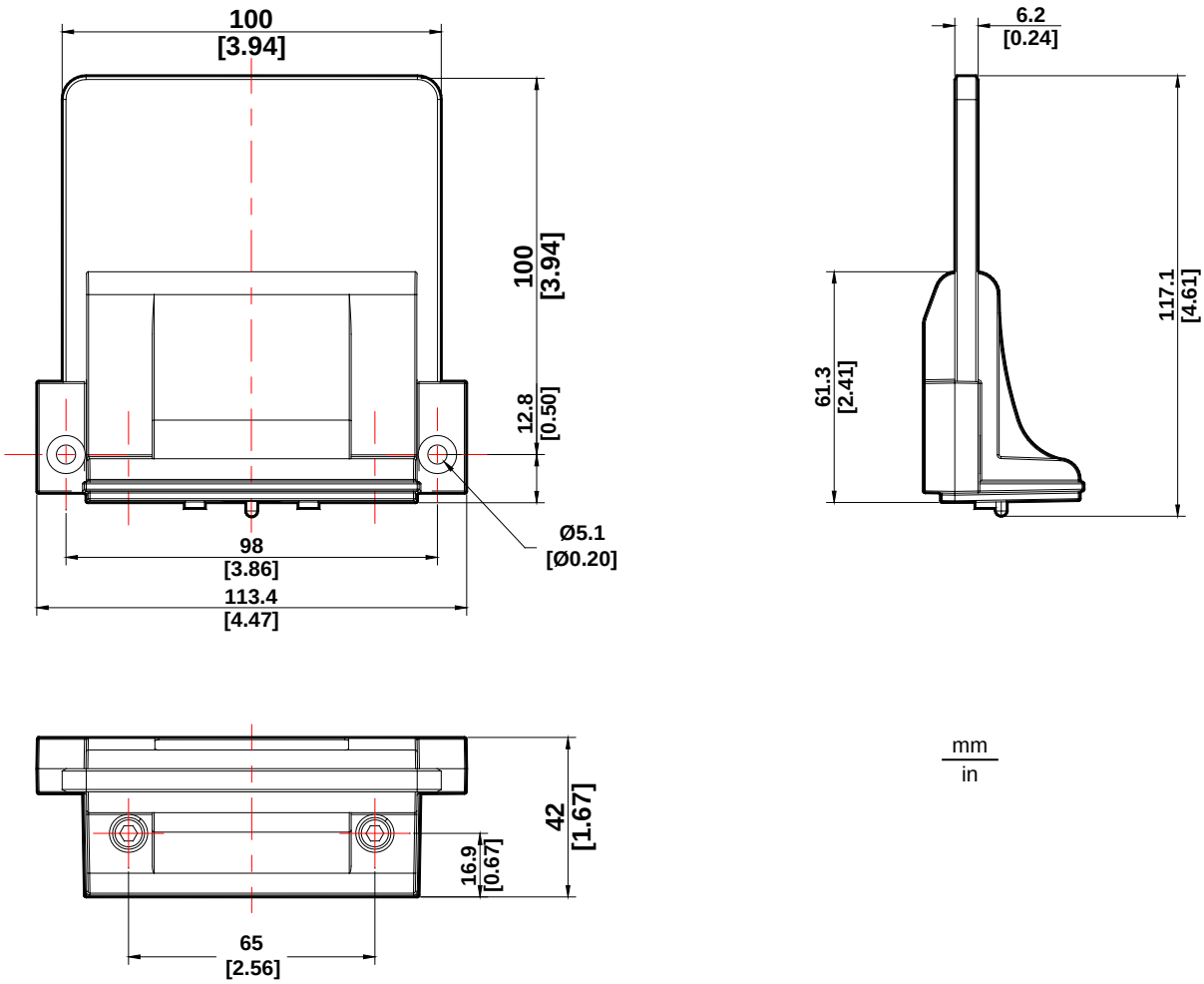


Figure 7 - BIS M-371-000-A01

BIS M-372-000-A01

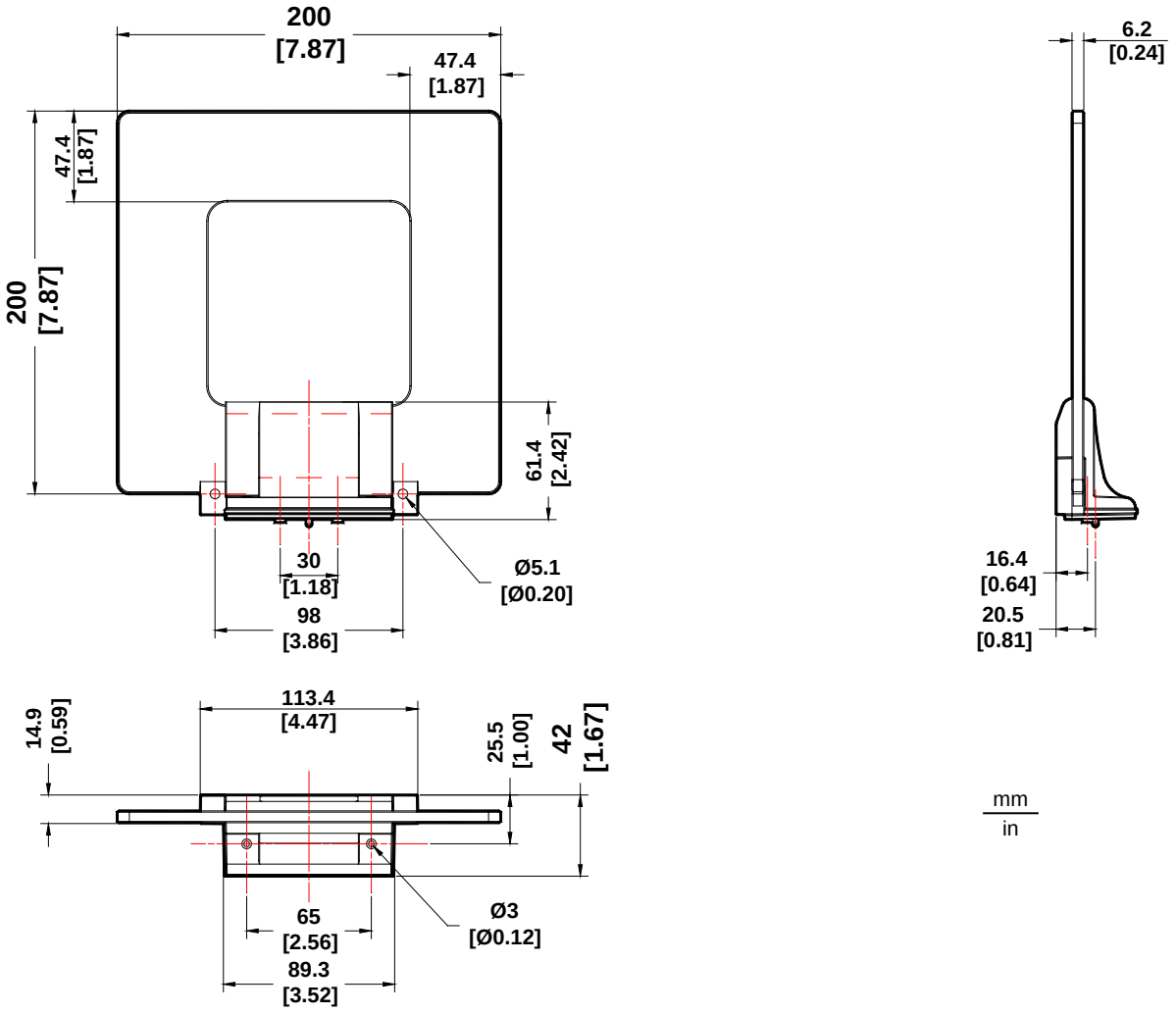


Figure 8 - BIS M-372-000-A01

BIS M-373-000-A01

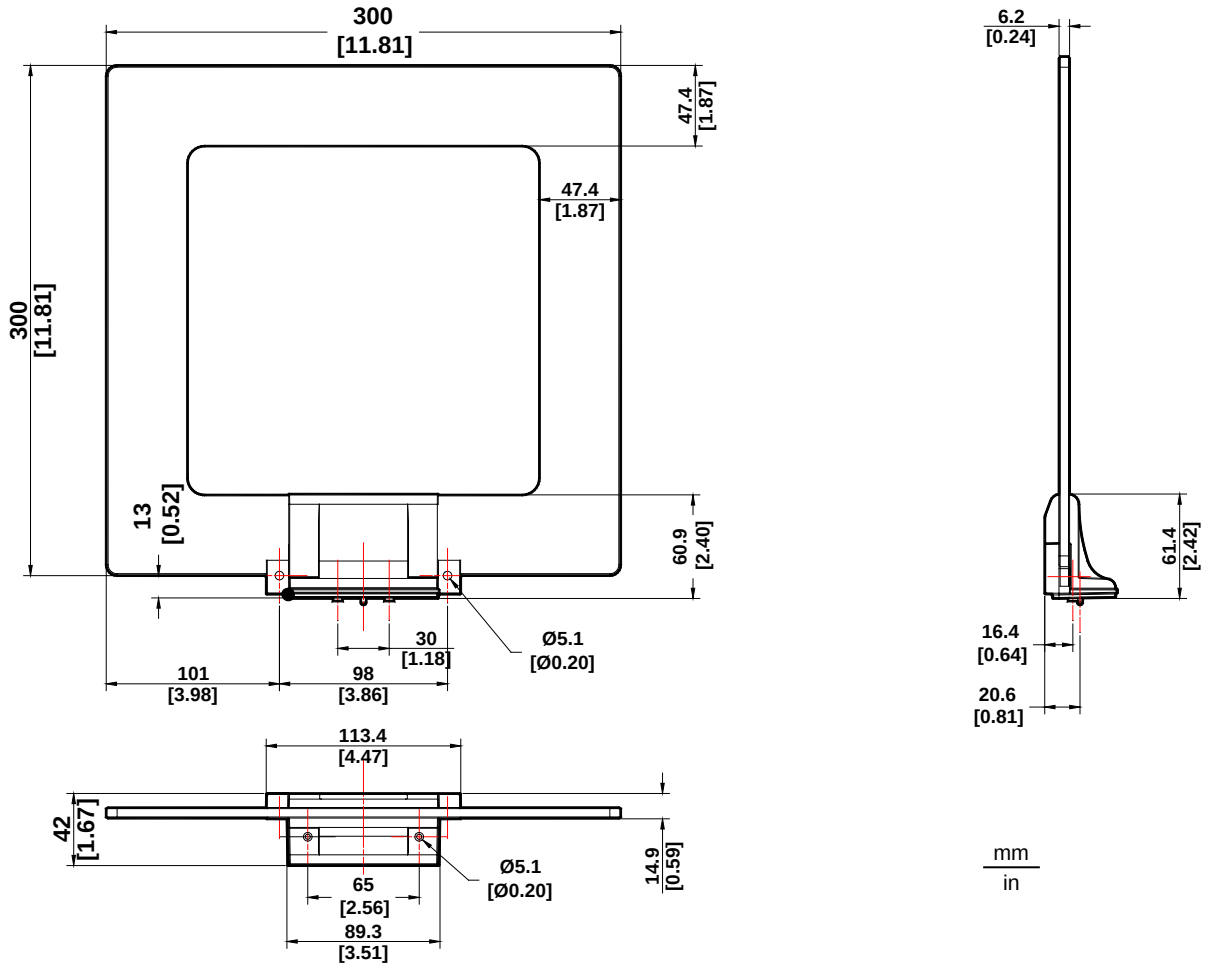


Figure 9 - BIS M-373-000-A01

BIS M-370-000-A02

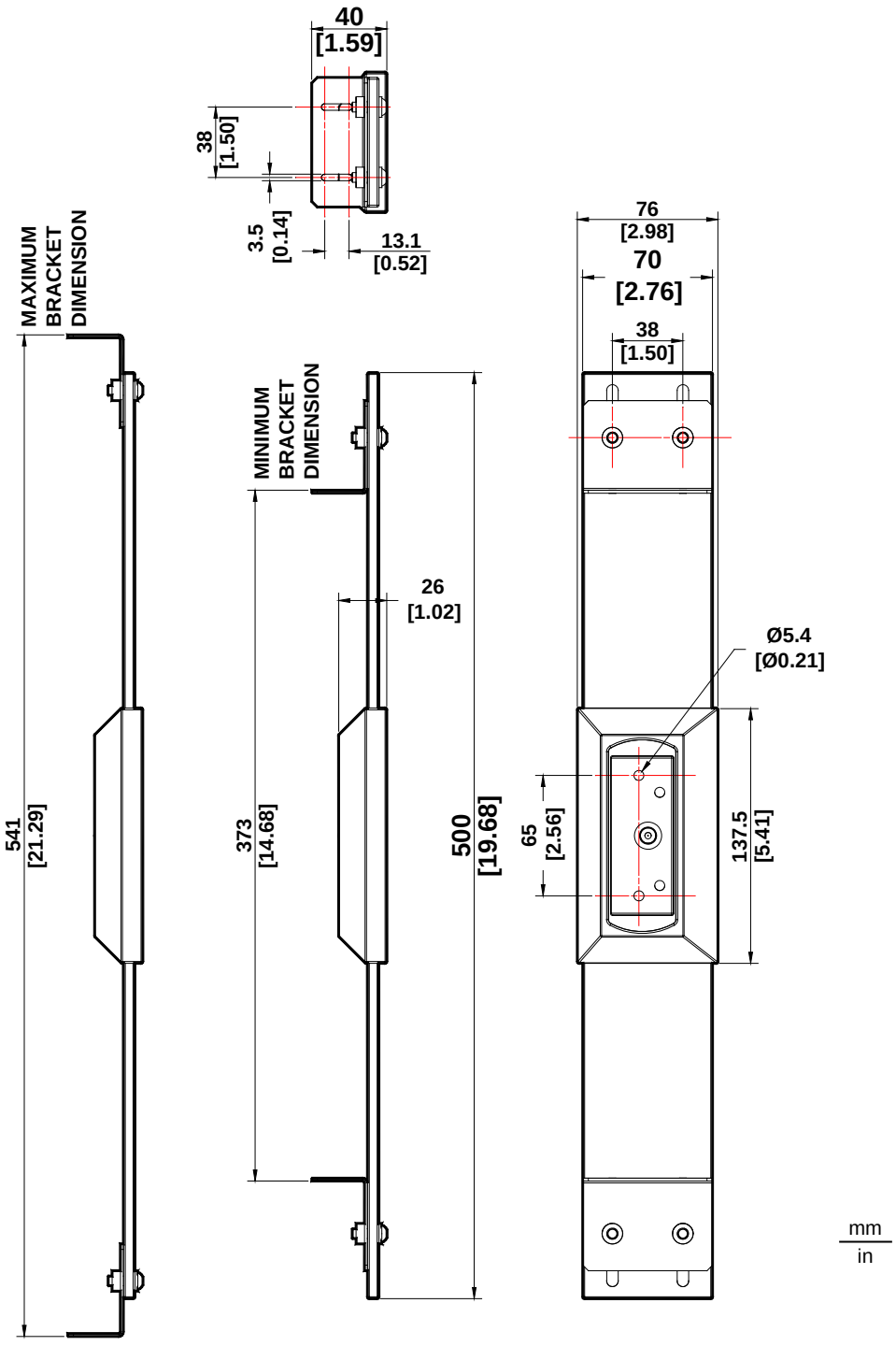


Figure 10 - BIS M-370-000-A02

2.2 BIS M-37_ ANTENNA MOUNTING

2.2.1 Direct Antenna Mounting

Only -371, -372, and -373 Antenna models

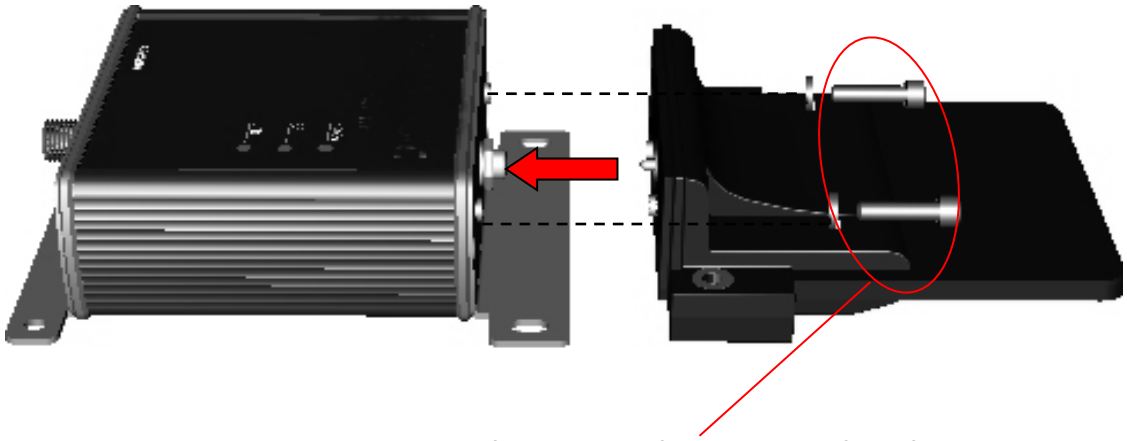


Figure 11 - Direct Antenna Mounting

The BIS M-37_RFID antennas (except BIS M-370-000-A02) are designed to be connected directly to the BIS M-62_ Processor units using the hardware included in the Processor unit package.

1. Connect the BIS M-37_ antenna to the BIS M-62_ processor unit by inserting the RCA antenna plug into the RF port (RCA jack) on the processor unit, as shown above.
2. Secure the antenna to the processor unit using the two 20 mm M5 screws and washers provided with each BIS M-62_ processor unit. You can use the 4 mm hex key wrench supplied with each Processor unit to tighten the screws to 1.7 Nm or 15 lbs per inch ± 10%.
3. Fasten the combined processor unit and antenna to your mounting fixture using M5 (or #10) diameter screws (not included). Pass the screws through the antenna's mounting holes and the processor unit bracket, and secure them with appropriate washers and nuts. Tighten screws to 1.7 Nm or 15 lbs per inch ± 10%.

To complete the installation, refer to the specific procedure for your Processor unit under par. 2.6.

2.2.2 Remote Antenna Mounting

Using BIS M-500-PVC-07-A01/02 Extension Cable

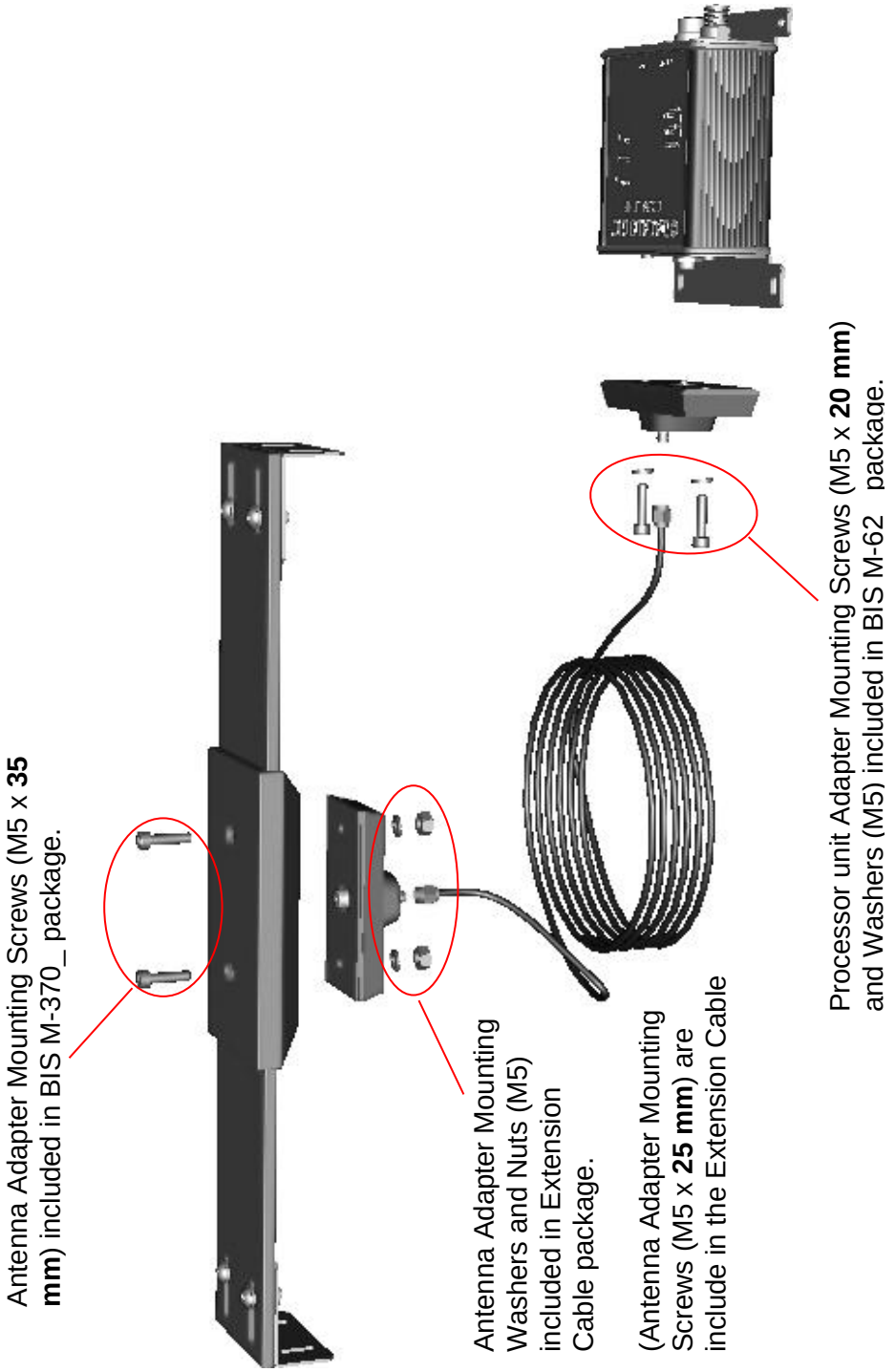

Antenna Adapter Mounting Screws (M5 x **35 mm**) included in BIS M-370_ package.
Antenna Adapter Mounting Washers and Nuts (M5) included in Extension Cable package.
(Antenna Adapter Mounting Screws (M5 x **25 mm**) are include in the Extension Cable
Processor unit Adapter Mounting Screws (M5 x **20 mm**) and Washers (M5) included in BIS M-62 package.

Figure 12 - Remote Antenna Mounting

All BIS M-37_RFID antennas can be connected remotely to the BIS M-62_ processor units through the BIS M-500-PVC-07-A01/02 Extension Cable.

NOTE

*You can use the 4 mm hex key wrench supplied with each Processor unit to tighten all screws to **1.7 Nm or 15 lbs per inch ± 10%.***

1. Mount the **processor unit Adapter** to the top of the processor unit using the two **20 mm** M5 screws and washers provided with each BIS M-62_ Processor unit.
2. Mount the **Antenna Adapter** to the bottom of the antenna as follows:
3. for Antenna models **-371**, **-372**, and **-373**, use the two **25 mm** M5 screws, washers and nuts provided with the BIS M-500-PVC-07-A01/02 Extension Cable kit.
4. for Antenna models **-370**, use the two **35 mm** M5 screws provided with the BIS M-370-000-A02 antenna. The M5 washers and nuts are in the Extension Cable kit.
5. Connect one end of the antenna extension cable to the RF port on the top of the Processor unit - Side Adapter, attach the other end to the RF port on the bottom of the Antenna - Side Adapter. Tighten both ends of the extension cable firmly by hand.
6. Fasten the processor unit and the antenna to your mounting fixtures using **M5 (or #10)** diameter screws (not included) and secure them with appropriate washers and nuts.

To complete the installation, refer to the specific procedure for your Processor unit under par. 2.6.

2.2.3 Minimum Mounting Distance Between Adjacent Antennas

ANT	-371	-372	-373	-370
-371	60 cm	75 cm	90 cm	50 cm
-372	75 cm	90 cm	1.2 m	65 cm
-373	90 cm	1.2 m	2 m	90 cm
-370	50 cm	65 cm	90 cm	50 cm

2.2.4 Antenna to Tag Range

RF read/write range can be adversely affected by many environmental factors, including electrical noise, metallic objects and liquids. The tag ranges below are provided for design purposes only. Testing should be performed in the actual environment for more precise range results.

Typical Antenna-to-Tag Ranges for some of Balluff Tags

Tag range values are listed in **mm / inches**.

Balluff Tag Model	BIS M-62_ _ -Series RFID Antenna [HF-ANT]				Testing Environment
	-371-	-371-	-371-	-371-	
BIS M-132-_ _	152 / 6.0	216 / 8.5	228 / 9.0	57 / 2.25	Free Air
BIS M-135-_ _	267 / 10.5	381 / 15.0	406 / 16.0	120 / 4.8	Free Air
BIS M-136-_ _	254 / 10.0	381 / 15.0	432 / 17.0	127 / 5.0	Attached to Metal with spacers
BIS M-184-03/L	216 / 8.5	292 / 11.5	343 / 13.5	82 / 3.25	Free Air
BIS M-132-_	64 / 2.5	64 / 2.5	Not Advised	Not Advised	Free Air
BIS M-134-_	115 / 4.5	155 / 6.1	162 / 6.4	44 / 1.8	Free Air
BIS M-183-07/L	85 / 3.4	95 / 3.7	Not Advised	Not Advised	Free Air

NOTE

For further information regarding the Antenna–to–Tag Ranges, please refer to the specific Tag's Datasheet.

2.3 ELECTRICAL CONNECTORS

2.3.1 RS232

The RS232 Connector (M12 8-pin, Male) is used for a point-to-point serial connection between a host computer and the BIS M-62_ processor unit.

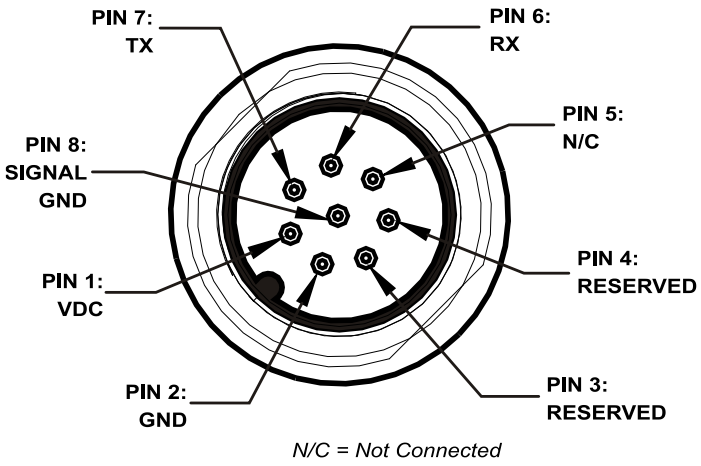


Figure 13 - RS232 Interface M12 8-pin Male Connector

Pin	Name	Function
1	Vdc	Input Power
2	GND	Power Ground
3	-	Reserved
4	-	Reserved
5	nc	
6	RX	RS232 Receive Data
7	TX	RS232 Transmit Data
8	SGND	Signal Ground

2.3.2 RS485

The Subnet16™ RS485 Connector (M12 5-pin, Male) is used for connecting the BIS M-62_ processor units to a Subnet16™ network.

These models are powered from the Subnet16™ network power.

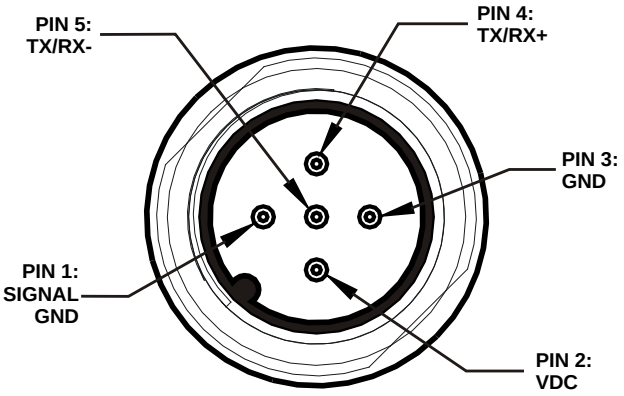


Figure 14 - RS485 Subnet16™ Interface M12 5-pin Male Connector

Pin	Name	Function
1	SGND	Signal Ground
2	Vdc	Subnet16™ Bus Power
3	GND	Subnet16™ Bus Ground
4	TX/RX+	Receive/Transmit Data positive
5	TX/RX-	Receive/Transmit Data negative

2.3.3 Industrial Ethernet IP

The Ethernet Connector (M12 4-pin D-coded, Female) is used for connecting the BIS M-62_ processor unit to an Ethernet network.

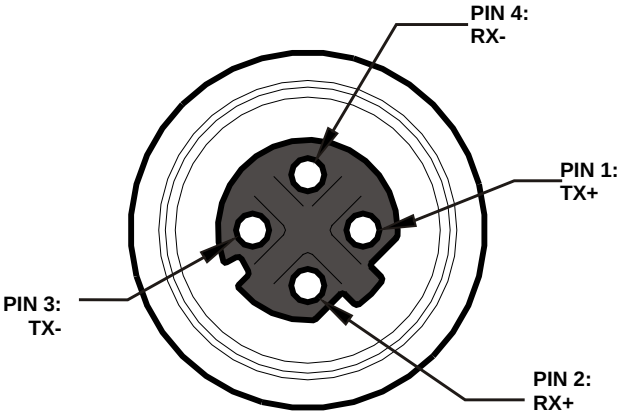
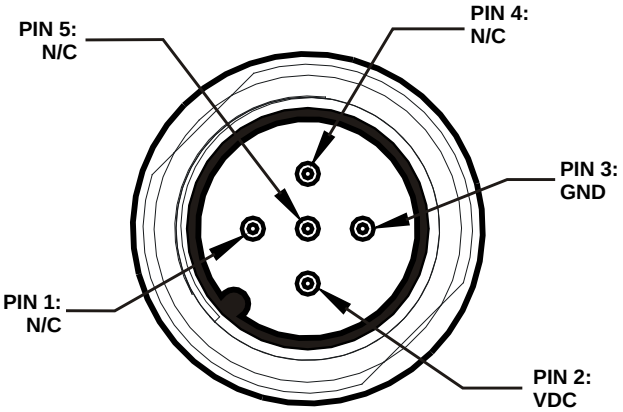


Figure 15 - M12 4-pin D-Coded Female Connector (for Ethernet)

Pin	Name	Function
1	TX+	Transmit Data positive
2	RX+	Receive Data positive
3	TX-	Transmit Data negative
4	RX-	Receive Data negative

The Industrial Ethernet models are powered through their VDC power connector (M12 5-pin, Male).



N/C = Not Connected

Figure 16 - M12 5-pin Male Connector (for Power Supply)

Pin	Name	Function
1	nc	
2	VDC	Input Power
3	GND	Power Ground
4	nc	
5	nc	

2.3.4 DeviceNet

The DeviceNet Connector (M12 5-pin, Male) is used for connecting the BIS M-62_ processor unit to a DeviceNet network.

These models are powered from the DeviceNet network power supply

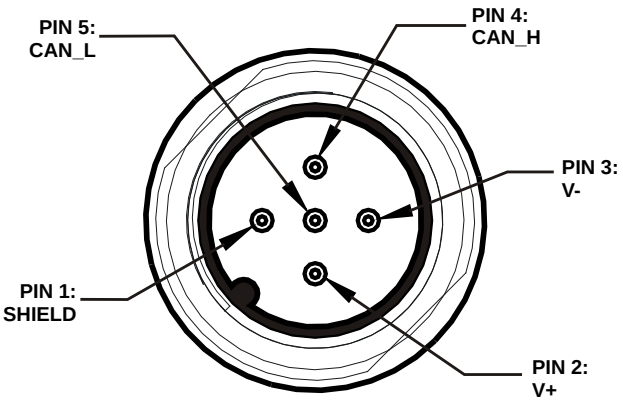


Figure 17 - M12 5-pin Male Connector (DeviceNet and Power Supply)

Pin	Name	Function
1	Shield	DeviceNet Bus Shield
2	V+	DeviceNet Bus Power
3	V-	DeviceNet Bus Ground
4	Can_H	Data positive
5	Can_L	Data negative

The RS232 Connector (M12 8-pin, Male) on the DeviceNet models is used for connecting the BIS M-62_ processor unit to a portable PC for configuration.

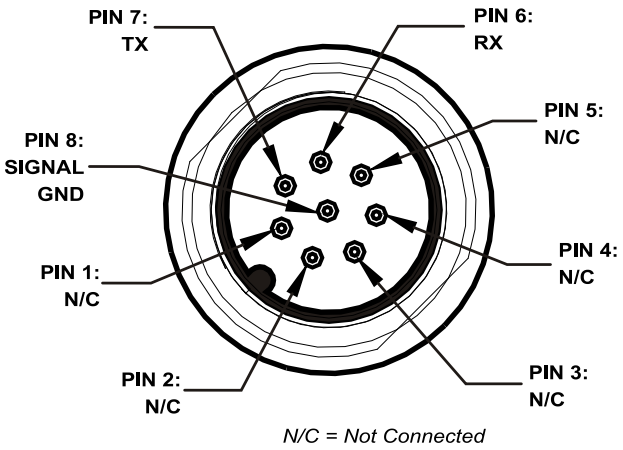


Figure 18 - M12 8-pin Male Connector (RS232)

Pin	Name	Function
1	nc	
2	nc	
3	nc	
4	nc	
5	nc	
6	RX	Receive Data
7	TX	Transmit Data
8	SGND	Signal Ground

2.3.5 Profibus

The Profibus IN Connector (M12 5-pin B-coded, Male) is used for connecting the BIS M-62_ processor unit to a Profibus network.

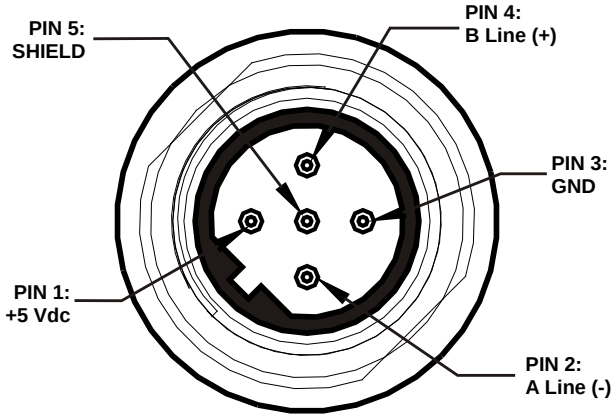


Figure 19 - M12 5-pin B-Coded Male Connector (Profibus-IN)

Pin	Name	Function
1	+5 Vdc	Bus Power for termination
2	A Line (-)	Data negative
3	GND	Bus Ground for termination
4	B Line (+)	Data positive
5	Shield	Profibus Shield

The Profibus OUT Connector (M12 5-pin B-coded, Female) is used for connecting the Processor unit to a Profibus network.

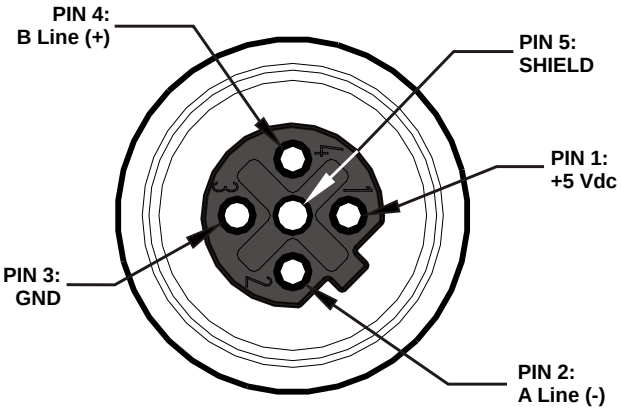
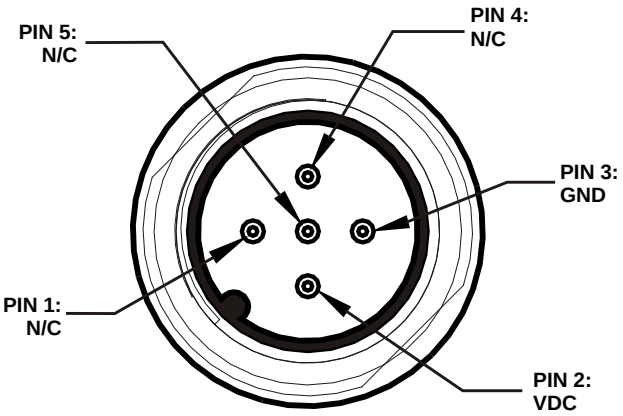


Figure 20 - M12 5-pin B-Coded Female Connector (Profibus-OUT)

Pin	Name	Function
1	+5 Vdc	Bus Power for termination
2	A Line (-)	Data negative
3	GND	Bus Ground for termination
4	B Line (+)	Data positive
5	Shield	Profibus Shield

The Profibus models are ONLY powered through their VDC power connector (M12 5-pin, Male).

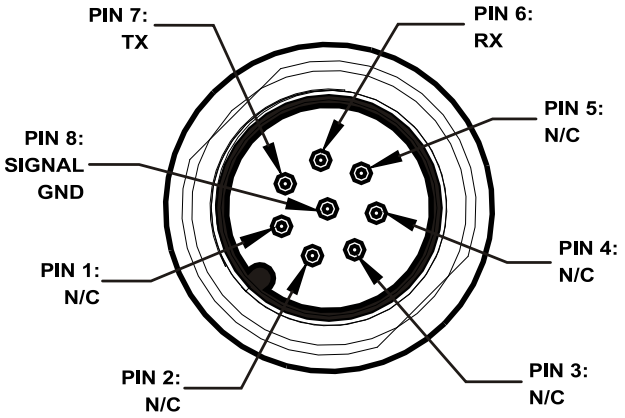


N/C = Not Connected

Figure 21 - M12 5-pin Male Connector (Power Supply)

Pin	Name	Function
1	Nc	
2	Vdc	Input Power
3	GND	Power Ground
4	Nc	
5	Nc	

The RS232 Connector (M12 8-pin, Male) on the Profibus models is used for connecting the Processor unit to a portable PC for configuration.



N/C = Not Connected

Figure 22 - M12 8-pin Male Connector (RS232)

Pin	Name	Function
1	nc	
2	nc	
3	nc	
4	nc	
5	nc	
6	RX	Receive Data
7	TX	Transmit Data
8	SGND	Signal Ground

2.3.6 Profinet

The PNT1 and PNT2 PROFINET Connectors (M12 4-pin D-coded, Female) are used for connecting the processor unit to a PROFINET network.

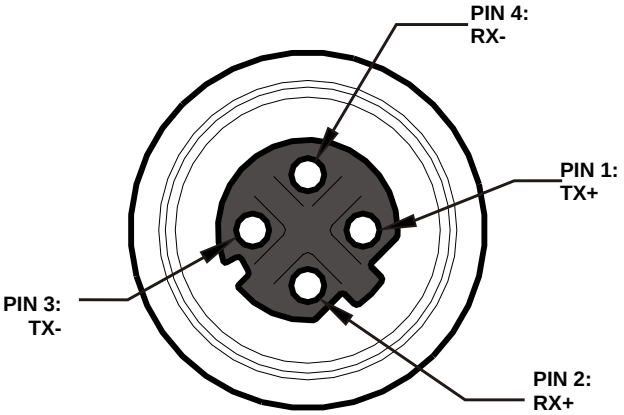
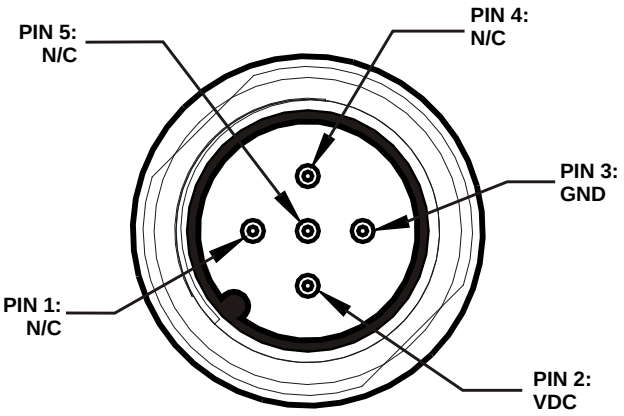


Figure 23 - M12 4-pin D-Coded Female Connector (for Profinet)

Pin	Name	Function
1	TX+	Transmit Data positive
2	RX+	Receive Data positive
3	TX-	Transmit Data negative
4	RX-	Receive Data negative

The Profinet models are powered through their VDC power connector (M12 5-pin, Male).



N/C = Not Connected

Figure 24 - M12 5-pin Male Connector (for Power Supply)

Pin	Name	Function
1	nc	
2	VDC	Input Power
3	GND	Power Ground
4	nc	
5	nc	

The RS232 Connector (M12 8-pin, Male) on the PROFINET models is used for connecting the processor unit to a portable PC for configuration.

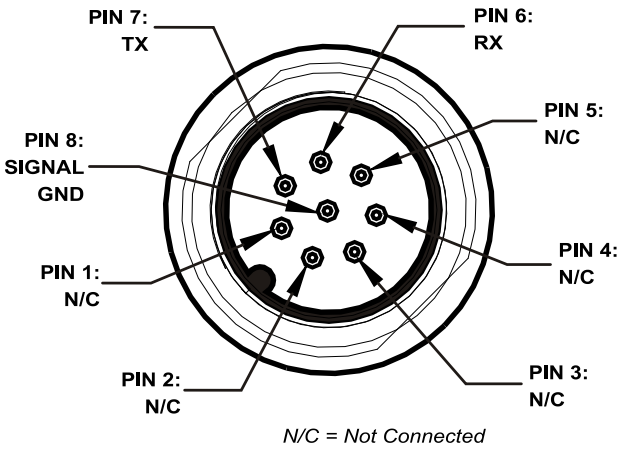


Figure 25 - M12 8-pin Male Connector (RS232)

Pin	Name	Function
1	nc	
2	nc	
3	nc	
4	nc	
5	nc	
6	RX	Receive Data
7	TX	Transmit Data
8	SGND	Signal Ground

2.3.7 Digital I/O (-12 models)

The Digital I/O Connector (M12 8-pin Female Connector) is used for connecting the processor unit to optional external digital input/output devices. See par. 2.7 for further details.

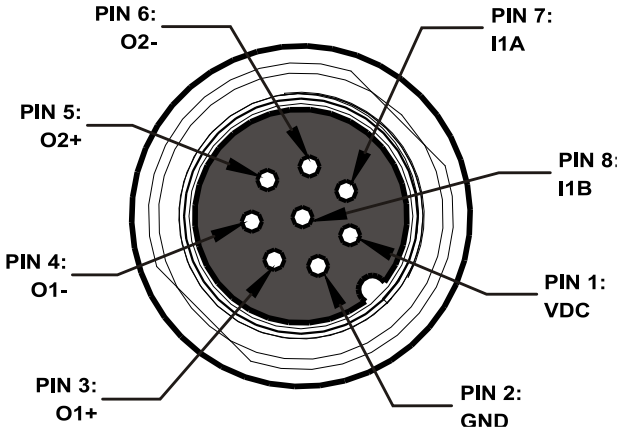


Figure 26 - M12 8-pin Female Connector (Digital I/O)

Pin	Name	Function
1	Vdc	Power from the Processor unit to the I/O device
2	GND	Power Ground
3	O1+	Output 1 positive
4	O1-c	Output 1 negative
5	O2+	Output 2 positive
6	O2-	Output 2 negative
7	I1A	Input 1A (optocoupled polarity insensitive)
8	I1B	Input 1B (optocoupled polarity insensitive)

CAUTION

The Vdc and Ground pins on this connector must not be used to power the processor unit. They can only be used to optionally supply the I/O device within the limits specified in par. 2.7 and in the Technical Features.

2.4 POWER & WIRING

The information presented below is provided to assist the installer in determining the amount of power that will be required by the Processor unit depending on the application.

2.4.1 Power Requirements

The HF-Series Processor unit requires an electrical supply voltage of 12 to 30 Vdc. Use a regulated power supply that is capable of delivering the requirements listed in the Technical Features.

For point-to-point or individually powered slave nodes, the calculation is straight forward. The calculation becomes more complex for network power sources.

The following information is provided to assist you in determining the power requirements of an RFID network application, in particular a Subnet16™ network.

NOTE

Power is applied directly to the Subnet16™ Network trunk and distributed through drop cables to the Gateway and RFID Processor units. By positioning the power supply near the middle of the network, you can limit voltage drop at the ends, (see par. 2.6.2 for network layout diagrams).

2.4.2 Total System Current Consumption

NOTE

The current consumption values of each product are given in the Technical Features paragraph of the relative Installation manual and refer to the min and max input voltage range. These values already include an adequate safety margin. The consumption values given in the following examples have been interpolated for an input voltage of 24 Vdc.

Max Gateway Current: 200 mA @ 12 Vdc (133 mA @ 24 Vdc).

Max Processor unit Current: 366 mA @ 24 Vdc for BIS M-62_ series

Calculating Total System Current Consumption:

Total System Current Consumption = [Max Gateway Current + (Max Processor unit Current x Number of Processor units)]

Example

A Subnet16™ network powered at 24 Vdc is composed of a BIS Z-GW-001- connecting eight BIS M-620-067-A01-04- Processor units.

Total System Current Consumption = [0.133 A + (0.366 A X 8)] = 3.061 A

2.4.3 Cable Voltage Drop

In addition, each RFID Processor unit on the Subnet will experience a certain amount of voltage drop depending on the length of the cable.

Cable Resistance per Meter

- ThinNet = **0.058 ohms** per meter per wire
- ThickNet = **0.0105 ohms** per meter per wire

Calculating Voltage Drop

Voltage Drop = (Max Processor unit Current x Number of Processor units) x (Cable Resistance per Meter per Wire[1] x Cable length in Meters)

Example

A Subnet16™ network is composed of a BIS Z-GW-001- connecting eight BIS M-620-067-A01-04-_ Processor units (366 mA each @ 24 Vdc). A total of 20 meters of ThinNet cables are used to connect the devices, which have Cable Resistance = 0.058 Ohms per meter per wire. The network power is 24 Vdc.

The voltage drop calculation must be conducted on the processor unit that is farthest from the Power Supply, as it will experience the greatest voltage drop.

NOTE

It is always recommended to power the network from the middle (T-configuration), to reduce total voltage drop at the ends. In the example below this allows the fourth processor unit and not the eighth to be the furthest from the power supply.

Voltage Drop = [0.133 A GWY + (0.366 A x 8 Processor units)] x [(0.058 x 2) x 20 meters] = 7.10 Vdc total voltage drop for 8 Processor units

24 Vdc - 7.10**/2** = 20.45 Vdc at processor unit number 4 of each branch

2.4.4 Current Rating for Cables

The maximum current rating for the Subnet16™ network using Balluff cables and accessories (BCCxxxx), is **4.0 A**.

[1] The resistance calculation must include both wires (Vdc and GND).

2.5 INSTALLATION GUIDELINES

2.5.1 Hardware Requirements

The following is a list of minimum components required to create an RFID reading system. Other components may be required depending on the processor unit model, see the specific installation procedure for your model.

- Host computer with specific interface (Serial, Subnet16™ or Fieldbus); Programmable Logic Processor unit (PLC) or PC
- RFID processor unit(s) (*BIS M-41x, BIS M-62x or BIS U-62x- Series Processors)*
- Adequate length cabling, connectors and terminators
- Sufficient power capable of powering all the RFID components
- Balluff RFID data carrier or labels: BIS M-1xx or BIS U-1xx

2.5.2 Installation Precautions

- RF performance and read/write range can be negatively impacted by the proximity of metallic objects and liquids. Avoid mounting the antenna within 15 cm (6 inches) of any metallic object or wet surface.
- Do not route cables near other unshielded cables or near wiring carrying high voltage or high current. Cross cables at perpendicular intersections and avoid routing cables near motors and solenoids.
- Avoid mounting the processor unit near sources of EMI (electro-magnetic interference) or near devices that generate high ESD (electro-static discharge) levels. Always use adequate ESD prevention measures to dissipate potentially high voltages.
- If electrical interference is encountered (as indicated by a significant reduction in read/write performance), relocate the processor unit to an area free from potential sources of interference.

2.6 TYPICAL LAYOUTS AND INSTALLATION PROCEDURES

2.6.1 Installing the BIS M-620-068-A01-00-S_ RS232

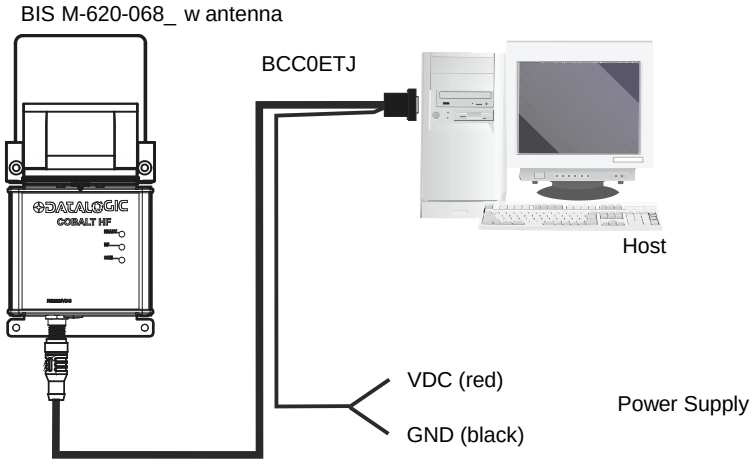


Figure 27 - RS232 Typical Layouts

The BIS M-620-068-A01-00-S_ Processor unit is designed for point-to-point RFID applications, where the distance from host to processor unit is less than 15 meters (50 feet). The processor unit connects directly to a serial communications port on a host computer via an RS232-compatible serial interface cable.

1. Select a suitable location for the BIS M-62_ Processor unit/Antenna.
2. Mount the BIS M-37_ antenna to the BIS M-62_ Processor unit, either directly or remotely, as described in par. 1.2.
3. Mount the processor unit and antenna to your mounting fixture using ***M5 (or #10)*** diameter screws (*not included*) and secure them with appropriate washers and nuts. Tighten screws to ***1.7 Nm or 15 lbs per inch ± 10%***.
4. Connect the BCC0ETJ M12 8-pin female connector to the M12 8-pin male interface connector on the BIS M-62_. Connect the BCC0ETJ 9-pin female D-sub connector to an RS232 COM port on the host computer. Tighten the cable's two locking thumbscrews.
5. Connect the power supply to the VDC (red) and GND (black) wires on the BCC0ETJ cable.
6. Apply power to the processor unit after all cable connections have been made. The LEDs on the unit will flash. The READY LED is ON after the power up sequence has completed.
7. On the host computer, set the COM port parameters to: 9600 baud, 8 data bits, 1 stop bit, no parity and no handshaking.

To verify operations, download the Balluff Dashboard™ Configuration Tool from www.balluff.com. The Balluff Dashboard™ Configuration Tool allows users to configure and control their BIS M-620-068-A01-00-S_ processor units and send RFID commands for testing purposes. See the Dashboard™ Manual for details.

2.6.2 Installing the BIS M-620-067-A1-04-S_ RS485

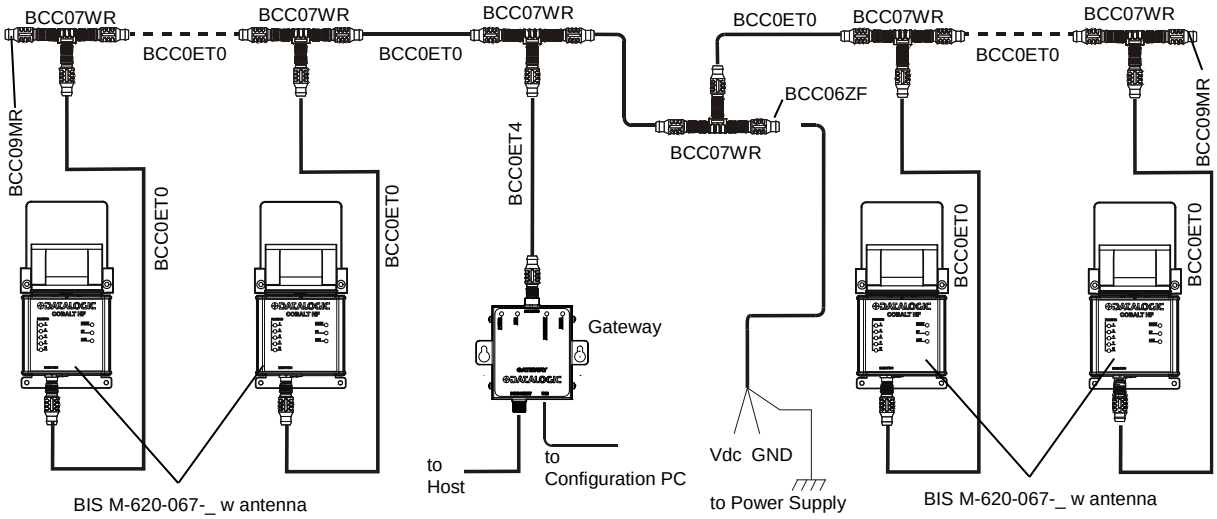


Figure 28 - RS485 Typical Layouts

See Gateway or Hub Reference Manual for further connection details.

The BIS M-620-067-A1-04-S_ Processor unit is designed for Subnet16™ RFID applications, where the processor unit is connected in an RS485 network via Subnet16™-compatible cables to the host through a Gateway or Hub.

1. Select a suitable location for the BIS M-62_ Processor unit/Antenna.
2. Mount the BIS M-37_ antenna to the BIS M-62_ Processor unit, either directly or remotely, as described in par. 2.2.
3. Mount the processor unit and antenna to your mounting fixture using ***M5 (or #10)*** diameter screws (*not included*) and secure them with appropriate washers and nuts. Tighten screws to ***1.7 Nm or 15 lbs per inch ± 10%***.
4. Attach a Subnet16™ compatible cable (i.e. BCC0ET0) to the M12 5-pin male Subnet16™ connector on the processor unit. Connect the other end of this cable to your Subnet16™ network.
5. To complete the Subnet16™ network installation, including power supply wiring, trunk wiring, network termination, Gateway/Hub wiring, and for a complete list of compatible accessory cables and Subnet16™ network layout examples, see the Subnet16™ Gateway or Subnet16™ Hub Reference Manuals.

After installation, the Subnet16™ network can be configured through the Subnet16™ Gateway/Hub using the Dashboard™ Configuration Tool. See the Dashboard™ Manual for details.

2.6.3 Installing the BIS M-626-069-A01-06_ Industrial Ethernet (IND)

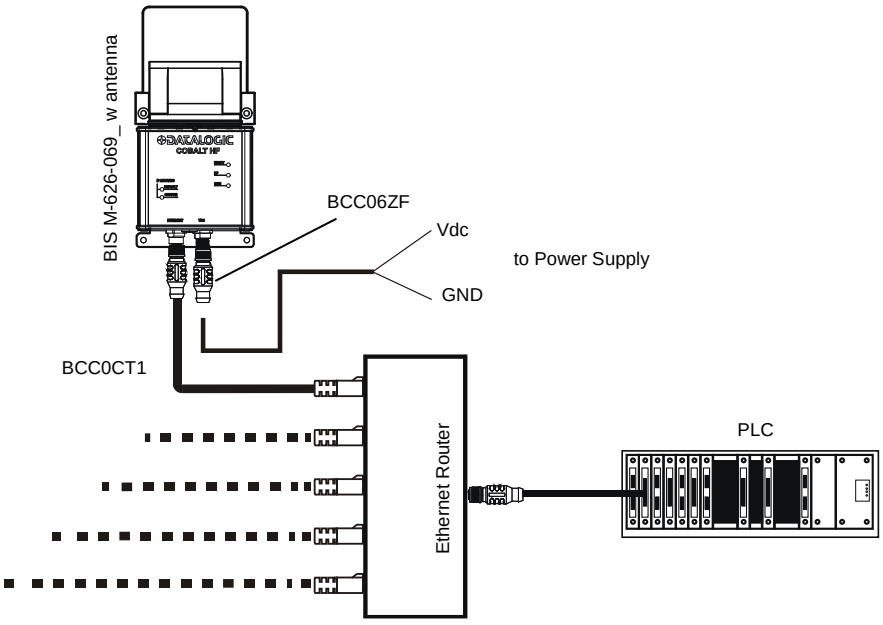


Figure 29 - IND Typical Layouts

The BIS M-626-069-A01-06_ Processor unit is designed for Industrial Ethernet IP RFID applications, where the processor unit is connected in an Ethernet IP TCP/IP network via compatible cables through a hub or directly to an Ethernet IP host.

1. Select a suitable location for the BIS M-626_ Processor unit/Antenna.
2. Mount the BIS M-37_ antenna to the BIS M-626_ Processor unit, either directly or remotely, as described in par. 2.2.
3. Mount the processor unit and antenna to your mounting fixture using ***M5 (or #10)*** diameter screws (*not included*) and secure them with appropriate washers and nuts. Tighten screws to ***1.7 Nm or 15 lbs per inch ± 10%***.
4. Connect the BCC0CT1 M12 4-pin male connector to the M12 4-pin female interface connector on the BIS M-626_. Connect the BCC0CT1 RJ45 male connector to the LAN hub/switch. If connecting directly to the host computer you will need to use an additional crossover cable.
5. Build a power supply cable using the BCC06ZF M12 5-pin female connector. Use minimum 24 AWG wires for connection to the power supply lines according to the Vdc connector pinout. Connect the BCC06ZF M12 5-pin female connector to the M12 5-pin male connector on the processor unit. Connect the other end of the cable (wires or user-supplied connectors) to the power supply.
6. Apply power to the processor unit after all cable connections have been made. The LEDs on the unit will flash. The READY LED is ON after the power up sequence has completed. Then one of the Ethernet IP Address LEDs will remain on, either Default or Custom.

To verify operations, download the Balluff Dashboard™ Configuration Tool from www.balluff.com. The Balluff Dashboard™ Configuration Tool allows users to configure and control their BIS M-626-069_ processor units and send RFID commands for testing purposes. See the Dashboard™ Manual for details.

2.6.4 Installing the BIS M-623-071-A01-03-S_ DeviceNet (DNT)

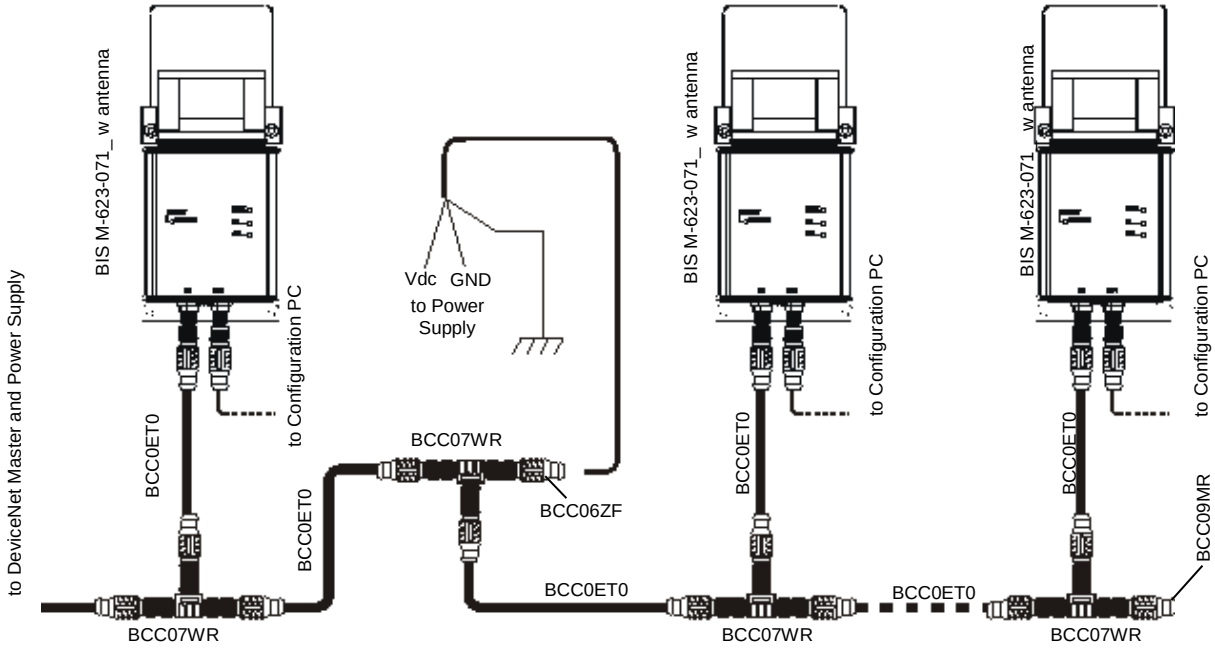


Figure 30 - DNT Typical Layouts

The BIS M-623-071-A01-03-S_ Processor unit is designed for DeviceNet RFID applications, where the processor unit is connected as a slave node in a DeviceNet network via compatible cables directly to a DeviceNet Master/Scanner (host). **The default Node ID is 63**.

1. Select a suitable location for the BIS M-623_ Processor unit/Antenna.
2. Mount the BIS M-37_ antenna to the BIS M-623_ Processor unit, either directly or remotely, as described in par. 2.2.
3. Mount the processor unit and antenna to your mounting fixture using ***M5 (or #10)*** diameter screws (*not included*) and secure them with appropriate washers and nuts. Tighten screws to ***1.7 Nm or 15 lbs per inch ± 10%***.
4. Attach a DeviceNet-compatible cable to the 5-pin, male M12 interface connector on the . Connect the other end of this cable to your DeviceNet network.
5. Turn your DeviceNet power supply ON. After a while the Devicenet LED will briefly flash alternatively Red and Green. The READY LED will be ON when the processor unit's startup procedure has completed.

To configure and control the BIS M-623-071 processor unit and send RFID commands for testing purposes, download and install the Balluff Dashboard™ Configuration Tool from www.balluff.com. The Dashboard™ Configuration Tool uses the PC RS232 serial port to communicate to the processor unit's RS232 serial port. To enable communication:

1. To connect the processor unit's RS232 serial port to the PC you have two choices; the first one is the quickest: a) Connect the BCC0ETJ M12 8-pin female connector to the M12 8-pin male interface connector on the BIS M-623_. Connect the BCC0ETJ 9-pin female D-sub connector to an RS232 COM port on the host computer, or, b) Build your own communication cable using the BCC0A03 connector M12 8-pin female connector and follow the schematic shown in par. 1.3.4.
2. On the host computer, set COM port parameters to: 9600 baud, 8 data bits, 1 stop bit, no parity and no handshaking.
3. Run the Dashboard™ Configuration Tool.

2.6.5 Installing the BIS M-622-070-A01-03-ST33 Profibus (PBS)

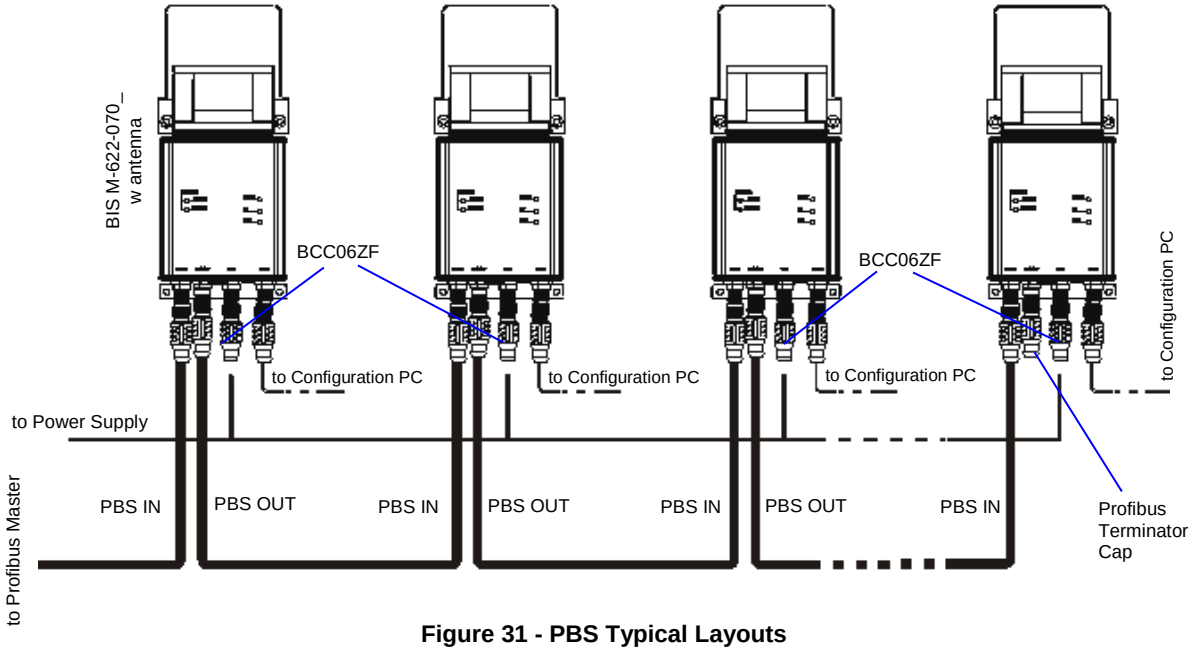


Figure 31 - PBS Typical Layouts

The BIS M-622-070-A01-03-ST33 Processor unit is designed for Profibus RFID applications, where the processor unit is connected as a slave node in a Profibus (DP) network via compatible cables directly to a Profibus Master (host). **The default Node ID is 63**.

1. Select a suitable location for the BIS M-622_ Processor unit/Antenna.
2. Mount the BIS M-37_ antenna to the BIS M-622_ Processor unit, either directly or remotely, as described in par. 2.2.
3. Mount the processor unit and antenna to your mounting fixture using ***M5 (or #10)*** diameter screws (*not included*) and secure them with appropriate washers and nuts. Tighten screws to ***1.7 Nm or 15 lbs per inch ± 10%***.
4. Attach Profibus-compatible data cables to the 5-pin B-Coded (reverse-keyed), male and female M12 interface connectors on the BIS M-622_. Connect the other end of the cables to your Profibus network.
5. Build a power supply cable using the BCC06ZF M12 5-pin female connector. Use minimum 24 AWG wires for connection to the power supply lines according to the Vdc connector pinout. Connect the BCC06ZF M12 5-pin female connector to the M12 5-pin male connector on the processor unit. Connect the other end of the cable (wires or user-supplied connectors) to the power supply.
6. Apply power to the processor unit after all cable connections have been made. The LEDs on the unit will flash. The READY LED is ON after the power up sequence has completed.

To configure and control the BIS M-622-070_ processor unit and send RFID commands for testing purposes, download and install the Balluff Dashboard™ Configuration Tool from www.balluff.com. The Dashboard™ Configuration Tool uses the PC RS232 serial port to communicate to the processor unit's RS232 serial port. To enable communication:

1. To connect the processor unit's RS232 serial port to the PC you have two choices; the first one is the quickest: a) Connect the BCC0ETJ M12 8-pin female connector to the M12 8-pin male interface connector on the BIS M-62_. Connect the BCC0ETJ 9-pin female D-sub connector to an RS232 COM port on the host computer, or, b) Build your own communication cable using the BCC0A03 connector M12 8-pin female connector and follow the schematic shown in par. 2.3.5.
2. On the host computer, set COM port parameters to: 9600 baud, 8 data bits, 1 stop bit, no parity and no handshaking.

Run the Dashboard™ Configuration Tool.

2.6.6 Installing the BIS M-628-075-A01-03-ST34 PROFINET (PNT)

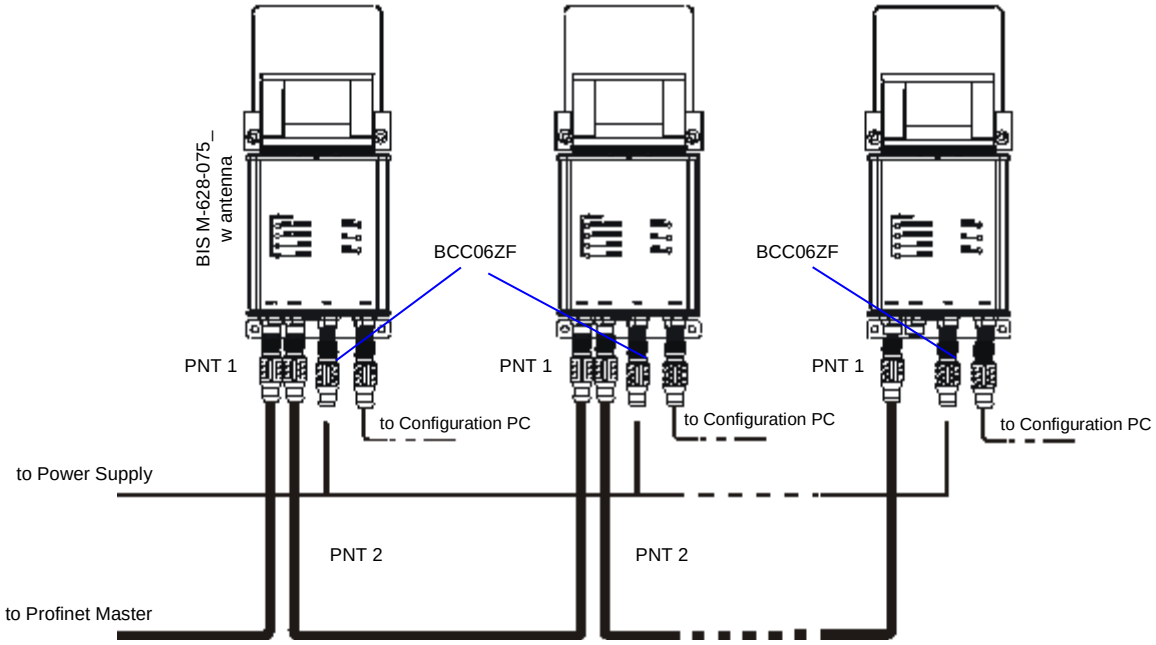


Figure 32 - PNT Typical Layouts

The BIS M-628-075-A01-03-ST34 Processor unit is designed for PROFINET RFID applications, where the processor unit is connected as a slave node in a PROFINET IO network via compatible cables directly to a PROFINET Master (host). **The default IP Address is 192.168.253.110**.

1. Select a suitable location for the BIS M-628_ Processor unit/Antenna.
2. Mount the BIS M-37_ antenna to the BIS M-628_ Processor unit, either directly or remotely, as described in par. 2.2.
3. Mount the processor unit and antenna to your mounting fixture using ***M5 (or #10)*** diameter screws (*not included*) and secure them with appropriate washers and nuts. Tighten screws to ***1.7 Nm or 15 lbs per inch ± 10%***.
4. Attach PROFINET-compatible data cables to the 4-pin D-Coded, female M12 interface connectors on the processor unit. Connect the other end of the cables to your PROFINET network.
5. Build a power supply cable using the BCC06ZF M12 5-pin female connector. Use 18 AWG (max) to 24 AWG (min) wires for connection to the power supply lines according to the Vdc connector pinout. Connect the BCC06ZF M12 5-pin female connector to the M12 5-pin male connector on the processor unit. Connect the other end of the cable (wires or user-supplied connectors) to the power supply.
6. Apply power to the processor unit after all cable connections have been made. The LEDs on the unit will flash. The READY LED is ON after the power up sequence has completed.

To configure and control the BIS M-628-075-A01-03-ST34 processor unit and send RFID commands for testing purposes, download and install the Balluff Dashboard™ Configuration Tool from www.balluff.com. The Dashboard Configuration Tool uses the PC RS232 serial port to communicate to the processor unit's RS232 serial port. To enable communication:

1. To connect the processor unit's RS232 serial port to the PC you have two choices; the first one is the quickest: a) Connect the BCC0ETJ M12 8-pin female connector to the M12 8-pin male interface connector on the BIS M-628_. Connect the BCC0ETJ 9-pin female D-sub connector to an RS232 COM port on the host computer, or, b) Build your own communication cable using the BCC0A03 connector M12 8-pin female connector and follow the schematic shown in par. 2.3.6.
2. On the host computer, set COM port parameters to: 9600 baud, 8 data bits, 1 stop bit, no parity and no handshaking.

Run the Dashboard™ Configuration Tool.

2.7 DIGITAL I/O (-12 MODELS)

2.7.1 Input

There is one optocoupled polarity insensitive input available on the Processor units with the I/O option. See par. 2.3.7 for pinout.

“Polarity Insensitive” means that, in the applications examples shown below, the user can exchange I1A with I1B without affecting the system behaviour.

The user can handle the input through specific commands (see par. 2.7.3 for the specific Command Protocol Reference Manual according to your processor unit model).

The electrical features of the input are:

Maximum voltage: 30 Vdc

Minimum voltage: 6 Vdc

Maximum current: 28 mA

The input is optocoupled and can be driven by both an NPN and PNP type command.

Input Connections Using Processor unit Power

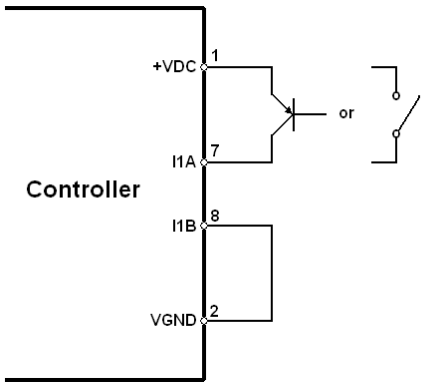


Figure 33 - PNP External Trigger Using Processor unit Power

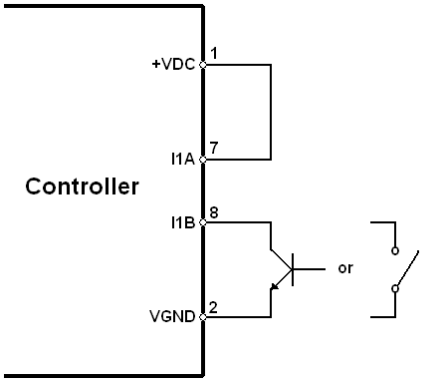


Figure 34 - NPN External Trigger Using Processor unit Power

Input Connections Using External Power

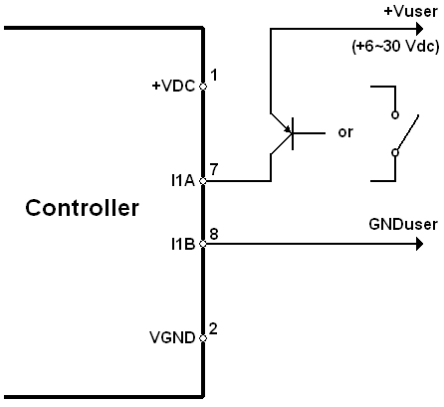


Figure 35 - PNP External Trigger Using External Power

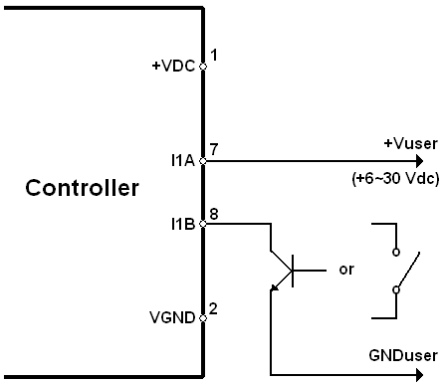


Figure 36 - NPN External Trigger Using External Power

2.7.2 Outputs

Two general purpose optocoupled outputs are available on the Processor units with the I/O option. See par. 2.3.7 for pinout.

The user can activate/deactivate the two outputs through specific commands (see par. 2.7.3 for the specific Command Protocol Reference Manual according to your Processor unit model).

When connected to an external circuit, the current must enter in O1+/O2+ and exit from O1-/O2-.

The electrical features of the outputs are:

Voltage Range: 6 ~ 30 Vdc

Maximum Current:
- If externally powered (by the user): 500 mA
- If powered by the Processor unit (pins 1 and 2 of the I/O connector): max. 300 mA (*)

(*) This is the maximum value of current computed as the <u>sum</u> of both the Outputs! In fact the output current supplied by the Processor unit is limited. In other words if only one output is active the maximum current value is 300 mA, but if both the outputs are active then each Output current must decrease (for example max. 150 mA for each Output).

Notes

- It should be noted that if the power supply for the I/O is supplied by the Processor unit (pins 1 and 2), the opto-isolation feature for the Input and Output sections will be lost, because the ground reference of the I/O and the Processor unit power supply is the same.
- A device that operates at 200 mA may damage the Digital Output due to inrush current if a current limiting device is not used and the current exceeds 500 mA (e.g. an incandescent light).
- The inductive "kick" that occurs when a relay is released (back EMF from a collapsing magnetic field) can impose a voltage higher than 30 Vdc that may damage the output transistor. To avoid this potential issue, employ a diode (D1) to clamp the back EMF. D1 should be a 1N4001 or equivalent.

The following connection diagrams show examples involving only Output1; the same principles are valid and applicable also to Output2.

Output Connections Using Processor unit Power

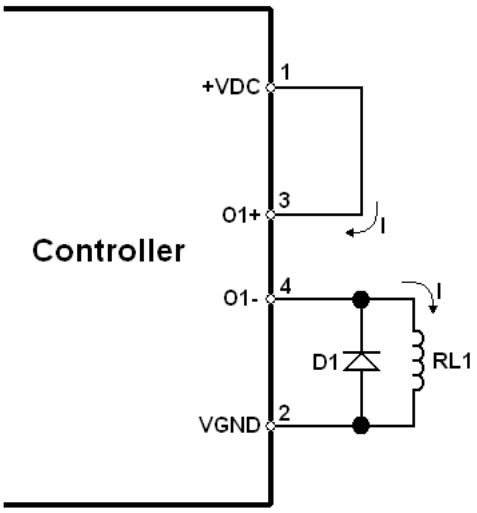


Figure 37 - Open Emitter (Sourcing) Output Using Processor unit Power

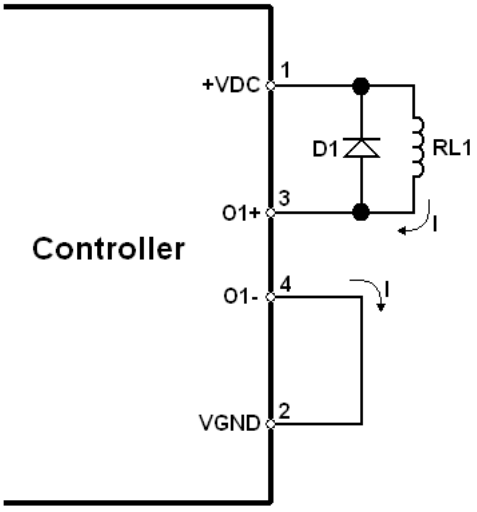


Figure 38 - Open Collector (Sinking) Output Using Processor unit Power

Output Connections Using External Power

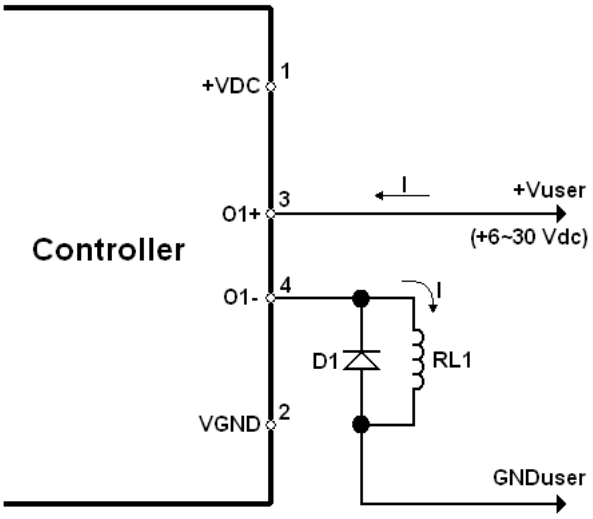


Figure 39 - Open Emitter (Sourcing) Output Using External Power

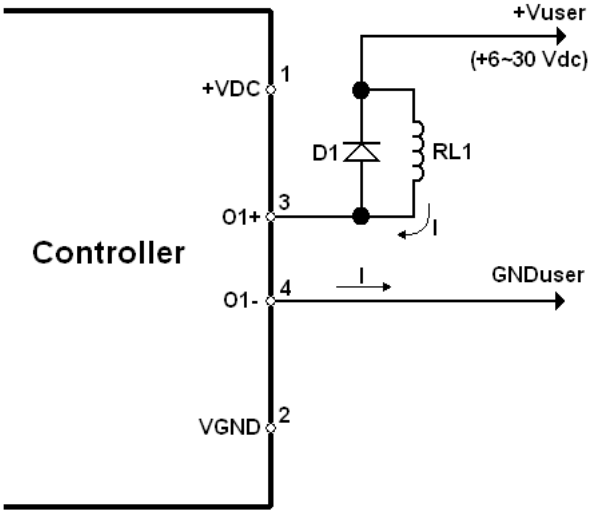


Figure 40 - Open Collector (Sinking) Output Using External Power

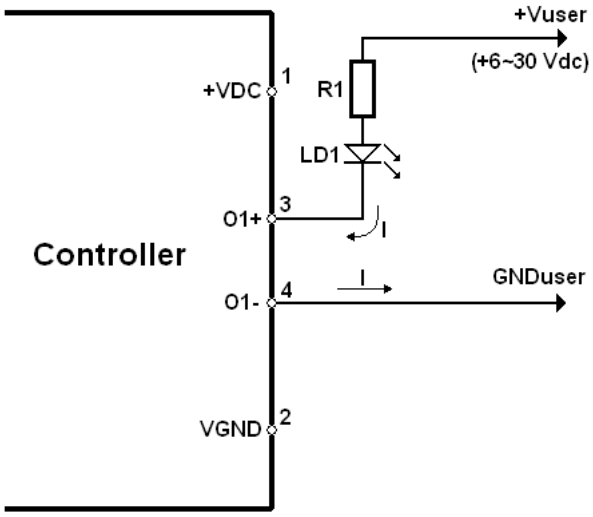


Figure 41 - Open Collector (Sinking) Output for a LED Using External Power

Note

- The resistor R1 in series with the LED LD1 sets the forward current; a value of 1.2 kΩ will provide about 20 mA LED current, when run from 24 Vdc.

2.7.3 Digital I/O Command Control

To handle the Input and Outputs, a set of CBx and ABx commands are available for the user. These commands include getting the status and setting/clearing the Input/Outputs.

For more details, refer to the Balluff CBx Command Protocol Reference Manual, and the Balluff ABx Fast Command Protocol Reference Manual, both available on the Balluff web site in the download section of the product page.

To determine which command protocol to utilize, please refer to the list below for the different Balluff RFID devices.

CBx Protocol

- BIS M-62_ Series Fieldbus and Non Fieldbus models: Industrial Ethernet (IND),

ABx Protocol (Fast and Standard)

- BIS M-620-068_ Series Serial models: RS232

NOTE

All RS485-based RFID Processor units are used in conjunction with Subnet16™ Gateway and Subnet16™ Hub interface modules, which all use the CBx Command Protocol.

3 LED INDICATORS

3.1 FRONT PANEL LEDS

3.1.1 BIS M-620-068-A01-00_ RS232 Models

LED Name	LED Color		LED Description
READY		**GREEN**	The READY LED is ON after the power up sequence has completed.
RF		**AMBER**	The RF LED illuminates when RF power is being transmitted by the antenna.
COM		**AMBER**	The COM (communications) LED flashes ON and OFF when data is being transmitted between the antenna and a tag. When in Continuous Read mode, the COM LED will remain ON and will turn OFF briefly only while data is being read from or written to a tag.

3.1.2 BIS M-620-067-A01-04_ RS485 Models

LED Name	LED Color		LED Description
READY		**GREEN**	The READY LED is ON after the power up sequence has completed.
RF		**AMBER**	The RF LED illuminates when RF power is being transmitted by the antenna.
COM		**AMBER**	The COM (communications) LED flashes ON and OFF when data is being transmitted between the antenna and a tag. When in Continuous Read mode, the COM LED will remain ON and will turn OFF briefly only while data is being read from or written to a tag.
NODE ID		**AMBER**	The five Node ID LEDs indicate (in Binary, from top to bottom) the current Node ID value assigned to the controller.

3.1.3 BIS M-626-069-A01-06_ INDUSTRIAL Models

LED Name	LED Color		LED Description
READY		**GREEN**	The READY LED is ON after the power up sequence has completed.
RF		**AMBER**	The RF LED illuminates when RF power is being transmitted by the antenna.
COM		**AMBER**	The COM (communications) LED flashes ON and OFF when data is being transmitted between the antenna and a tag. When in Continuous Read mode, the COM LED will remain ON and will turn OFF briefly only while data is being read from or written to a tag.
DEFAULT		**AMBER**	Default IP Address enabled **(192.168.253.110)**
CUSTOM		**AMBER**	User assigned IP Address enabled

3.1.4 BIS M-623-071-A01-03-ST30 DEVICENET Models

LED Name	LED Color		LED Description
READY		**GREEN**	The READY LED is ON after the power up sequence has completed.
RF		**AMBER**	The RF LED illuminates when RF power is being transmitted by the antenna.
COM		**AMBER**	The COM (communications) LED flashes ON and OFF when data is being transmitted between the antenna and a tag. When in Continuous Read mode, the COM LED will remain ON and will turn OFF briefly only while data is being read from or written to a tag.
DEVICENET		**GREEN/RED**	**SOLID GREEN:** on-line and connection established. **FLASHING GREEN:** on-line, but no connections established, or needs commissioning. **FLASHING RED:** connection timed out, or recoverable fault detected. **SOLID RED:** unrecoverable fault detected (i.e., duplicate node address).

3.1.5 BIS M-622-070-A01-03-ST33 PROFIBUS Models

LED Name	LED Color		LED Description
READY		**GREEN**	The READY LED is ON after the power up sequence has completed.
RF		**AMBER**	The RF LED illuminates when RF power is being transmitted by the antenna.
COM		**AMBER**	The COM (communications) LED flashes ON and OFF when data is being transmitted between the antenna and a tag. When in Continuous Read mode, the COM LED will remain ON and will turn OFF briefly only while data is being read from or written to a tag.
STATUS		**GREEN/RED**	**SOLID GREEN:** initialized. **FLASHING GREEN:** initialized, diagnostic event(s) present. **SOLID RED:** exception error
OP MODE		**GREEN/RED**	**SOLID GREEN:** on-line, data exchange **FLASHING GREEN:** on-line, but idle. **FLASHING RED (1 FLASH):** parametrization error **FLASHING RED (2 FLASHES):** Profibus configuration error

3.1.6 BIS M-628-075-A01-03-ST34 PROFINET Models

LED Name	LED Color		LED Description
READY		**GREEN**	The READY LED is ON after the power up sequence has completed.
RF		**AMBER**	The RF LED illuminates when RF power is being transmitted by the antenna.
COM		**AMBER**	The COM (communications) LED flashes ON and OFF when data is being transmitted between the antenna and a tag. When in Continuous Read mode, the COM LED will remain ON and will turn OFF briefly only while data is being read from or written to a tag.
MOD STATUS		**GREEN/RED**	**SOLID GREEN:** initialized, Normal Operation **FLASHING GREEN (1 FLASH):** diagnostic event(s) present. **FLASHING GREEN (2 FLASHES):** blink used for node identification **SOLID RED:** exception error **FLASHING RED (1 FLASH):** configuration error **FLASHING RED (2 FLASHES):** IP address error **FLASHING RED (3 FLASH):** Station Name error **FLASHING RED (4 FLASHES):** Internal error
NET STATUS		**GREEN**	**SOLID GREEN:** IO Controller connected in RUN **FLASHING GREEN:** IO Controller connected in STOP
LINK 1 **LINK 2**		**AMBER**	**SOLID AMBER:** Profinet link established

4 CONFIGURATION METHODS

There are several configuration methods available for your processor unit depending on the interface type and application:

- Configuration Tag
- Configuration Tools: Balluff Dashboard™ and C-Macro Builder™
- Command Protocol

4.1 CONFIGURATION TAG

A configuration tag is included with your BIS M-62_ processor unit. This can be used to reset all BIS M-62_ processor units to their factory default configuration settings.

For Subnet16™ models (BIS M-62_ RS485 models), this tag can also be used to set the Node ID of each processor unit in the network.

BIS M
Configuration Tag
BALLUFF
INSTRUCTIONS
This tag can be used to restore factory defaults, test RFID controllers, and assign Subnet16 Node ID addresses. See the product Reference Manual for further details.
To Restore Factory Defaults
1. Place this Configuration Tag in the antenna's RF field
2. Cycle power to the controller or issue the <<Reset Controller>> command; the controller LEDs blink
3. After the LED stop blinking, remove the Configuration Tag from the antenna's RF field and then power down. Factory default values have been restored.

Figure 42 - BIS M Series Configuration Tag

4.1.1 Node ID Configuration Using Configuration Tags

Only RS485-based RFID processor units can be connected to a Gateway's Subnet network and each must be assigned a unique Node ID value between 1 and 16.

When an RFID processor unit is connected to the Gateway's Subnet network, the Gateway will query the new processor unit to obtain certain configuration values (specifically the Node ID number). If the Gateway does not detect a Node ID conflict, it will "allow" the RFID processor unit onto the Subnet network.

By using the ***BIS M Series Configuration Tag*** that is included with each RS485-based BIS M-62_ processor unit, the Node ID value can be dynamically assigned by the Gateway or can be manually assigned by the user.

For the Gateway to dynamically assign a Node ID value to a processor unit, the processor unit must first be initialized with the Node ID value of zero. This is the equivalent of having no Node ID assigned.

NOTE

All Balluff RS485-based processor units' ship with their Node ID value set to 0.

When a powered processor unit (that is set to Node ID 0) is connected to the Subnet, it will not initially be recognized by the Gateway until the Configuration Tag is placed in the antenna's RF field. After a few seconds the processor unit will display its new assigned Node ID value in binary code from right to left or (top to bottom) using the five amber Node LEDs on the processor unit, see Figure B, 7.

When dynamically assigning a Node ID value for a new processor unit, the Gateway will either assign the next available Node ID value or the value that the Gateway recognizes as offline or "*missing*" – that is, a Node ID value that previously existed, but has since disappeared from the network.

Because the Gateway stores a backup of each Subnet Node's configuration, should an RFID processor unit ever fail, a replacement processor unit can be installed quickly and easily. The new processor unit will be automatically assigned the same Node ID value and configuration as the replaced processor unit, provided the Configuration Tag is introduced to the antenna field after startup and then removed.

NOTE

Avoid that the configuration tag is simultaneously read by more than one processor unit.

4.2 CONFIGURATION TOOLS

Balluffoffers the following powerful RFID configuration utilities for Microsoft Windows 2000, XP, Vista and 7 systems:

- **Balluff Dashboard™**
- **C-Macro Builder™**

These configuration tools can be downloaded from the Balluff website: www.balluff.com

4.2.1 Configuration Using Balluff Dashboard™

The ***Balluff Dashboard™ Configuration Tool*** is a software application that allows users to view, modify, save and update the configuration settings of their BIS M-62_ processor units. Follow the instructions below to operate the *Balluff Dashboard™ Configuration Tool* and to set the BIS M-62_ device's configuration.

1. Install the Processor unit as described in the relevant sub-paragraph in 2.6.

2. Connect the Processor unit to your PC, power up and wait for the boot procedure to finish.

3. Run the *Balluff Dashboard™*.

4. From the Connection screen, choose your processor unit from the list.

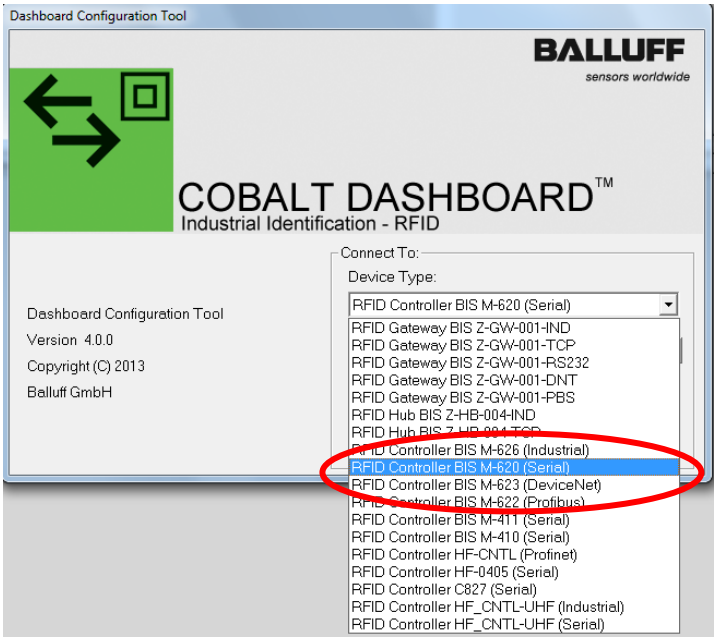


Figure 43 - Balluff Dashboard™ HF RS232 Processor unit Selection

5. Choose the appropriate COM port and Baudrate, (or IP Address for Ethernet models); then click "Connect".

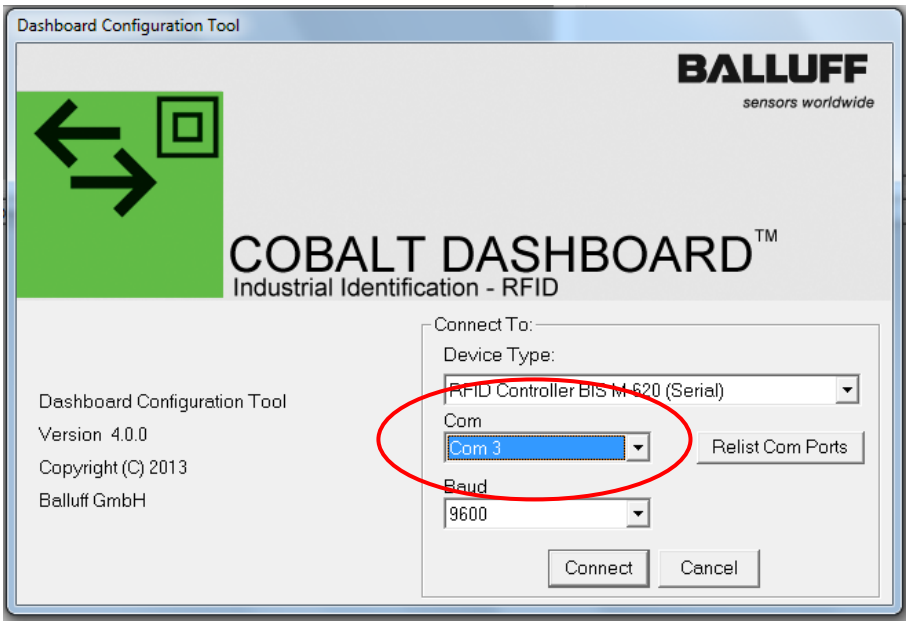


Figure 44 - Balluff Dashboard™ COM Port and Baudrate Selection

The Dashboard should send some commands to retrieve device and configuration information from the device. If communications are set up correctly, the device configuration area within the Balluff Dashboard™ should now look something like this:

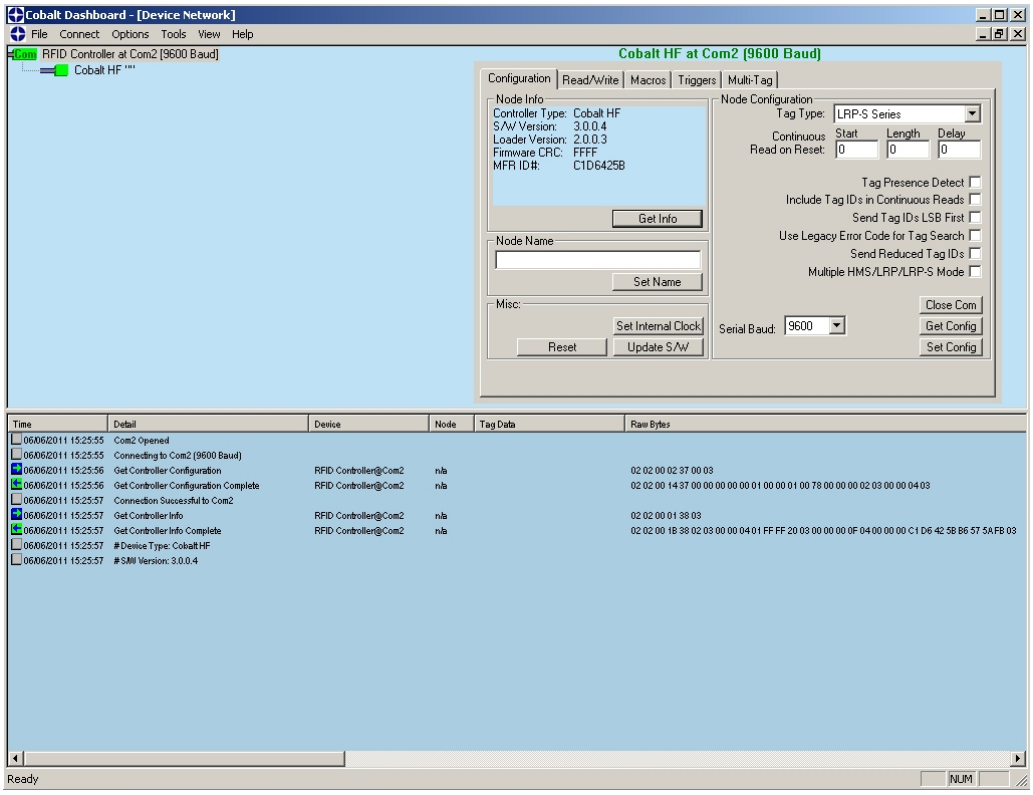


Figure 45 - Balluff Dashboard™ HF RS232 Processor unit Configuration

See the Balluff Dashboard™ User's Manual for more configuration details.

4.2.2 Software Upgrades Using Balluff Dashboard™

The Balluff Dashboard™ Configuration Tool also allows for processor unit software upgrades.

NOTE

For the BIS M-62_ Processor units, software upgrades/downgrades can only be made within the same major release family (i.e. 2.xx <> 2.xy). Do not attempt software upgrades/downgrades between major releases (i.e. 2.xx <> 3.xx).

See the Balluff Dashboard™ User's Manual for more details on software upgrades.

4.2.3 Creating and Using RFID Macros with C-Macro Builder™

What are RFID Command Macros?

RFID Command Macros are a powerful feature of Balluff BIS M-62_ Processor units. Macros are simple programs that direct a processor unit to execute multiple pre-programmed instructions.
Because macros reside within the processor unit's internal memory, they can be programmed to instruct the processor unit to automatically read and/or write a specified set of data to an RFID tag without the processor unit ever having to receive a command from the host. In fact, the processor units do not even require a connection to a host in order to execute macros.

Each macro can contain up to 255 bytes of data and each supported processor unit can store up to eight macros at a time. Though they are stored locally on the processor unit, macros are also backed up in the Gateway's flash memory as well.

Why use macros?

The power of macros is in distributed intelligence, the reduction in network bus traffic and the ability to accelerate routine decision making at the point of data collection.

What can macros do?

In addition to the automated reading and writing of data, macro capabilities include:

- The ability to write time stamps to RFID tags
- The ability to filter command responses to only those of interest to the host (such as when an error occurs or when a tag has arrived in the RF field)
- The ability to harness powerful logic and triggering capabilities such as; read, write, start/stop continuous read, data compare, branch, transmit custom string, and set outputs.

What is a macro trigger?

Macros are initiated by “triggers.” Triggers can be configured in numerous ways. A simple command from the host, such as “execute macro number three” can be considered a trigger. Triggers can be configured, for example, to activate a macro when a tag enters or leaves a processor unit’s RF field.

Balluff RFID processor units can store up to eight separate triggers in addition to the eight macros they can also house. Any trigger can activate any of the eight stored macros.

How are macros created?

Macros are created using the powerful, yet simple, C-Macro Builder™ Configuration Tool from Balluff. The easy to use GUI allows the user to create powerful RFID macro programs quickly and easily.
When used with Balluff Dashboard™ Configuration Tool, users can effortlessly download, erase, and manage their macros and triggers, as well as set the operational configurations of their RFID processor units and Subnet16™ Gateways.

Which communication interfaces support the use of macros?

Macros are supported on the following BIS M-62_ Processor units: Ethernet, Profibus, Profinet, DeviceNet, RS232 and USB interfaces.

What happens to existing Macros if a processor unit must be replaced?

When using a Subnet16™ Gateway, users do not need to worry. Macros and triggers normally residing in an RFID processor unit's flash memory are always backed up in the Gateway's flash memory as well. Therefore, if a processor unit should ever require replacement, all existing macro and trigger settings are automatically exported from the Gateway to the new RFID processor unit.

In short, when an RFID processor unit is initially connected to the Gateway, macro and trigger data from the processor unit's flash memory is compared to the macro and trigger data backed up in the Gateway from the previous RFID processor unit. If the data does not match that which is stored on the Gateway, the processor unit's flash memory will be overwritten with the backed up data stored in the Gateway's flash memory.

How can I learn more about the Dashboard and C-Macro Builder?

More information regarding macros, triggers, uploading, downloading, configuring and monitoring Balluff RFID equipment is available in the respective User's Manuals for these products, which are available on the Balluff website at:

www.balluff.com

C-Macro Builder™ is an easy to use GUI-driven Configuration Tool for Windows that allows users to create powerful RFID command macro programs.

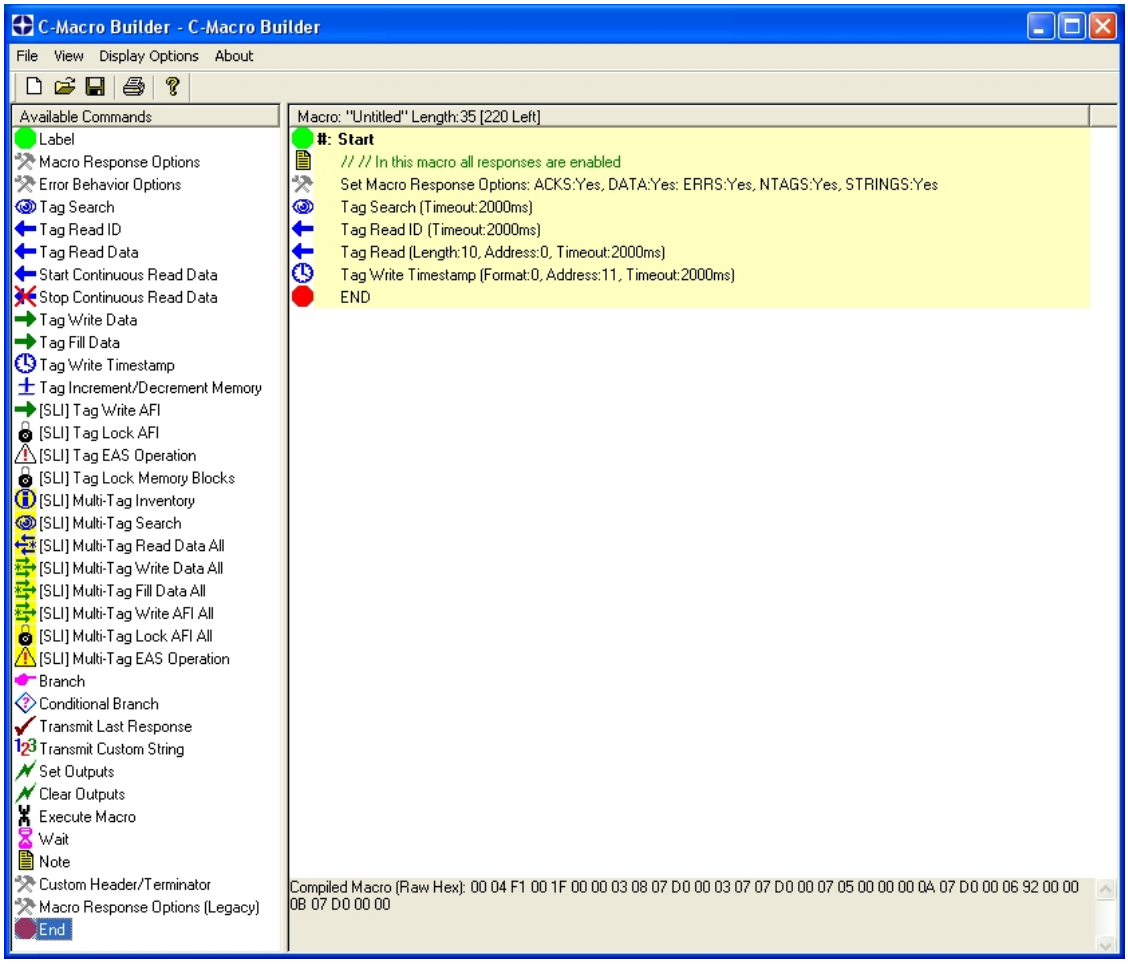

C-Macro Builder - C-Macro Builder
File View Display Options About
Available Commands
Label
Macro Response Options
Error Behavior Options
Tag Search
Tag Read ID
Tag Read Data
Start Continuous Read Data
Stop Continuous Read Data
Tag Write Data
Tag Fill Data
Tag Write Timestamp
Tag Increment/Decrement Memory
[SLI] Tag Write AFI
[SLI] Tag Lock AFI
[SLI] Tag EAS Operation
[SLI] Tag Lock Memory Blocks
[SLI] Multi-Tag Inventory
[SLI] Multi-Tag Search
[SLI] Multi-Tag Read Data All
[SLI] Multi-Tag Write Data All
[SLI] Multi-Tag Fill Data All
[SLI] Multi-Tag Write AFI All
[SLI] Multi-Tag Lock AFI All
[SLI] Multi-Tag EAS Operation
Branch
Conditional Branch
Transmit Last Response
Transmit Custom String
Set Outputs
Clear Outputs
Execute Macro
Wait
Note
Custom Header/Terminator
Macro Response Options (Legacy)
End
Macro: "Untitled" Length:35 [220 Left]
#: Start
// // In this macro all responses are enabled
Set Macro Response Options: ACKS:Yes, DATA:Yes: ERRS:Yes, NTAGS:Yes, STRINGS:Yes
Tag Search (Timeout:2000ms)
Tag Read ID (Timeout:2000ms)
Tag Read (Length:10, Address:0, Timeout:2000ms)
Tag Write Timestamp (Format:0, Address:11, Timeout:2000ms)
END
Compiled Macro (Raw Hex): 00 04 F1 00 1F 00 00 03 08 07 D0 00 03 07 07 D0 00 07 05 00 00 00 0A 07 D0 00 06 92 00 00 0B 07 D0 00 00

Figure 46 - C-Macro Builder™

NOTE

For specific information regarding the configuration and use of either of these utilities, please see the accompanying documentation included when downloading each software application.

4.3 COMMAND PROTOCOLS

HF-Series processor units can be directly programmed using a proprietary command protocol over the specific host interface. This is useful for processor units connected to a PLC over a Fieldbus network (i.e. DeviceNet, Profibus, Ethernet/IP, Profinet, etc.).

To determine which command protocol to utilize, please refer to the list below for the different BIS M-62_ devices.

CBx Protocol

- BIS M-62_ (Fieldbus and Non-Fieldbus) models: Industrial Ethernet BIS M-626 (IND), DeviceNet BIS M-623 (DNT), Profibus BIS M-622 (PBS), Profinet BIS M-628 (PNT)

ABx Protocol (Fast and Standard)

- BIS M-620_ Serial models: RS232

NOTE

All RS485-based RFID processor units are used in conjunction with Subnet16™ Gateway and Subnet16™ Hub interface modules, which all use the CBx Command Protocol.

Refer to the specific Command Protocol Reference Manual for details.

5 ETHERNET/IP INTERFACE

NOTE

For BIS M-626-069-A01--06-ST3_ models.

- Users of the *Balluff Dashboard™ Configuration Tool* should exit the application before attempting communications between the Industrial BIS M-626 and an EtherNet/IP host Programmable Logic Controller (PLC).
- When installing the Controller for communication over EtherNet/IP, the ODVA Guidelines for EtherNet/IP Media System installation should be followed (refer to www.odva.org, ODVA **PUB00148R0** (Pub 148), EtherNet/IP Media Planning and Installation Manual, 2006 ODVA).
- Follow ODVA recommendations for switching and wiring Ethernet/IP.
- If the Ethernet/IP network enables I/O Messaging for remote I/O, etc., or if other UDP traffic is present, then the Controller must be protected by a switch that incorporates IGMP Snooping or a VLAN.

The BIS M-626-069-A01--06-ST3_ model is designed to support many common Industrial Ethernet protocols and can be implemented in a wide variety of existing host / PLC applications. One such popular Ethernet protocol is ***Ethernet/IP*** (**EIP**).

This chapter focuses on the process of setting up the BIS M-626 Industrial RFID Controller to communicate (via Ethernet/IP) with a ControlLogix Programmable Logic Controller (PLC).

Also in this chapter are descriptions of the Balluff ***HTTP Server*** and ***OnDemand Utilities***, as well as systematic instructions to help configure the BIS M-626 Industrial RFID Controller for Ethernet/IP environments.

NOTE

This manual assumes that users are already familiar with Ethernet/IP, industrial Ethernet communications protocols and programmable logic controller technologies. For specific information regarding the protocol used by your particular RFID application, please refer to the appropriate documentation from your host / PLC program provider.

5.1 ETHERNET/IP CONFIGURATION OVERVIEW

Based upon on the standard TCP/IP protocol suite, EtherNet/IP is a high-level application layer protocol for industrial automation applications that uses traditional Ethernet hardware and software to define an application layer protocol that structures the task of configuring, accessing and controlling industrial automation devices.

Ethernet/IP classifies Ethernet nodes as predefined device types with specific behaviors. The set of device types and the EIP application layer protocol is based on the Common Industrial Protocol (CIP) layer used in ControlNet. Building on these two widely used protocol suites, Ethernet/IP provides a seamlessly integrated system from the RFID Subnet network to the Host and enterprise networks.

The BIS M-626_ is designed to communicate as an EtherNet/IP client device, which will receive and execute RFID commands issued by the host / PLC (acting as EtherNet/IP Server).

Paragraphs 1.3 through 1.7 contain instructions that will help you accomplish the following:

- Assign the BIS M-626_ an IP address via *HTTP Server*
- Configure the BIS M-626's Subnet Node via *OnDemand Utilities*
- Create "*Controller Tags*" in the PLC
- Verify PLC and BIS M-626_ Subnet Node connectivity

5.2 HTTP SERVER & ONDEMAND PLC SUPPORT

Below is a partial list of the programmable logic controllers that are supported by the Balluff *HTTP Server* and *OnDemand Utilities*:

- ControlLogix – OnDemand supports all current versions
- RA's PLC5E releases:
- Series C, Revision N.1
- Series D, Revision E.1
- Series E, Revision D.1
- PLC5 "Sidecar" Module Series B, Revision A with EIP support
- SLC5/05 releases:
- Series A with firmware revision OS501, FRN5
- All Series B and Series C PLC Controllers

5.3 HTTP SERVER AND ONDEMAND UTILITIES

Embedded in the BIS M-626-069-A01--06-ST31 is an ***HTTP Server,*** which provides a Website-like interface and a suite of configuration tools.

Through the use of the BIS M-626's *HTTP Server*, users can access, modify and save changes to the unit's Industrial Ethernet configuration, IP address, and *OnDemand* mode settings.

The *OnDemand Utilities* will be used later in this chapter to link the BIS M-626 to specific *Controller Tags* as defined in Rockwell Automation's (*RA*) ControlLogix PLC.

CAUTION

Disable any firewall services affecting or running locally on the host computer. Firewalls can potentially block communications between the BIS M-626 *and the host and/or PLC.*

NOTE

*In ControlLogix, a "**Controller Tag**" is a small block of internal memory that is used to hold outgoing (command) and incoming (response) data. Within each controller tag, information is stored in two-byte segments, known as registers or "words."*

OnDemand is the Balluff approach to adding *Change of State* messaging to ControlLogix and legacy support for *RA PLC5E* and *RA SCL5/05* programmable logic controllers.

5.4 IP CONFIGURATION VIA HTTP SERVER

To configure the BIS M-626 for Ethernet communications, begin by assigning the controller a locally compatible IP address.

Through a standard Web browser, you can utilize the BIS M-626's *HTTP Server* to access an embedded suite of controller configuration tools, called the "***OnDemand Utilities***." Among its features is the ability to modify and save changes to the controller's IP address, which is stored internally on the BIS M-626.

BIS M-626 Industrial Ethernet RFID Controller - Default IP Address:
192.168.253.110

Setting the BIS M-626 IP Address

To set the BIS M-626's IP address using the *HTTP Server,* follow the steps below:

1. Open a Web browser on the PC.
2. In the URL address field, enter the BIS M-626's IP address (*192.168.253.110* = *factory default*).
3. Press ***ENTER***.

The *HTTP Server - Main Page* will be displayed.

HTTP Server – Main Page

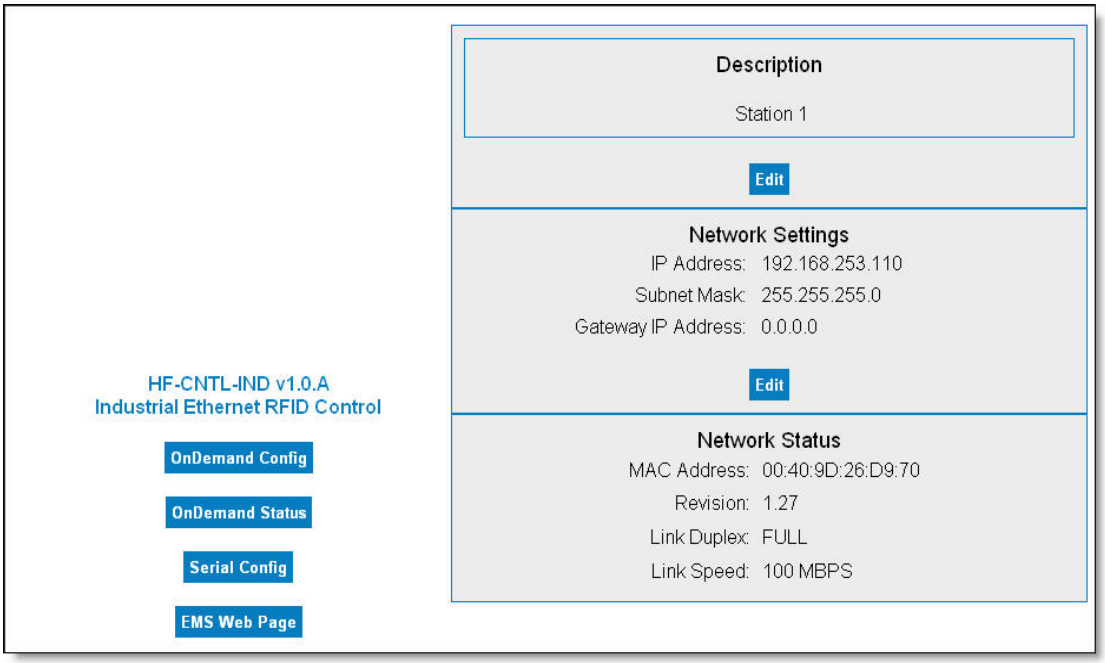
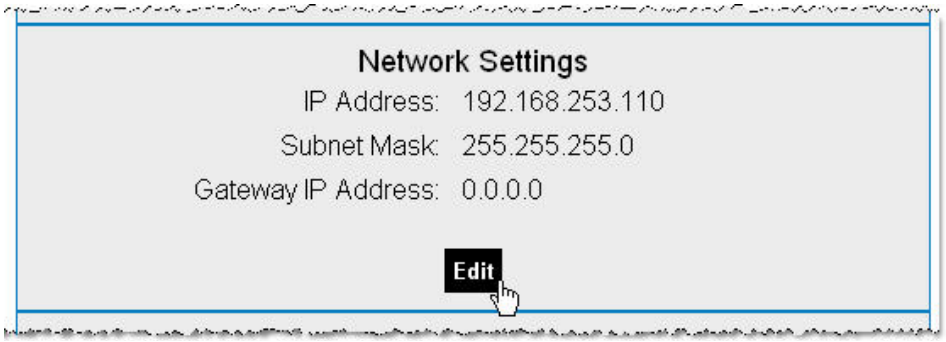


Figure 47 - The HTTP Server - Main Page

The ***HTTP Server - Main Page*** lists the IP address and network settings currently stored on the BIS M-626.

4. Click the button labeled "***EDIT***", located below "***Network Settings.***"



The IP Configuration Page will be displayed.

IP Configuration Page

The *IP Configuration Page* is used to modify and save changes to the IP Address, Subnet Mask and (Network) Gateway IP Address.

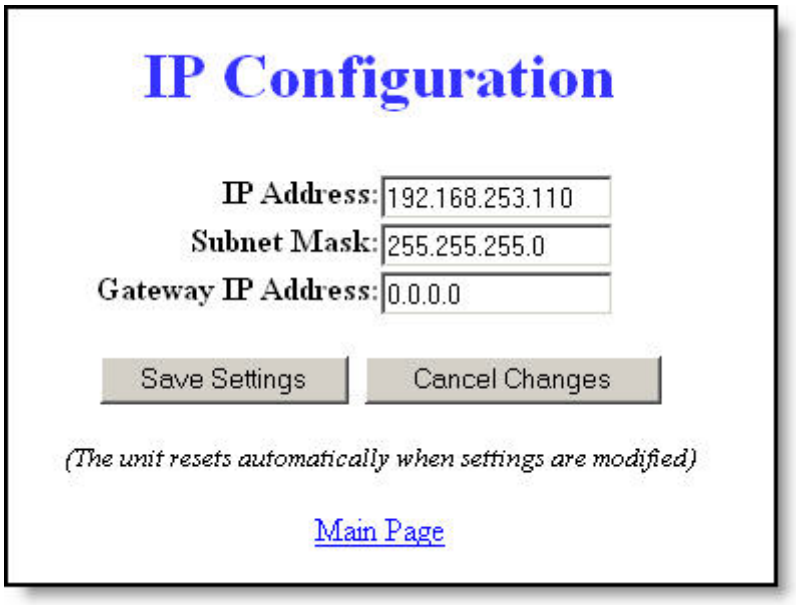


Figure 48 - The IP Configuration Page

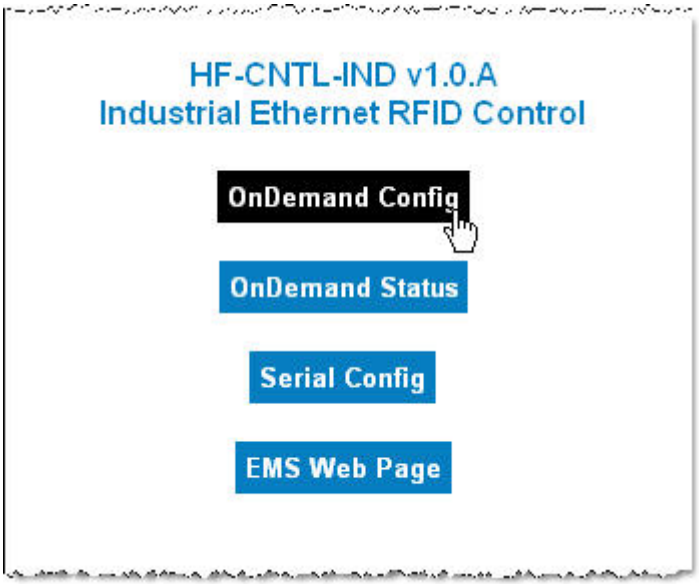
5. In the fields provided, enter your new IP configuration values for the BIS M-626.
6. Click the **"*Save Settings***" button to store your new IP configuration, then cycle power to the controller to store the changes in the main memory. The Ethernet module will reset and your IP changes will be implemented.
7. After the BIS M-626 has restarted, verify the new IP configuration by opening a Web browser and manually entering the BIS M-626's new IP address in the URL field. If successful, you should arrive back at the *HTTP Server – Main Page*.

5.5 ONDEMAND CONFIGURATION FOR ETHERNET/IP

Now that you have configured the BIS M-626's IP address, you will need to use the embedded *HTTP Server* to access the BIS M-626's ***OnDemand Configuration Page***. Through the use of the *OnDemand Configuration Page,* the BIS M-626 can be configured to communicate with a *ControlLogix* PLC.

To configure the BIS M-626's *OnDemand Configuration* settings, follow the steps below:

1. Open a Web browser on the host and enter the BIS M-626's new IP address in the URL field. The *HTTP Server – Main Page* will be displayed.
2. At the *HTTP Server – Main Page*, click the button labeled "***OnDemand Config***."



The *OnDemand Configuration Page* will be displayed.

OnDemand Configuration Page

The ***OnDemand Configuration Page*** allows you to modify the settings of the BIS M-626's Node.

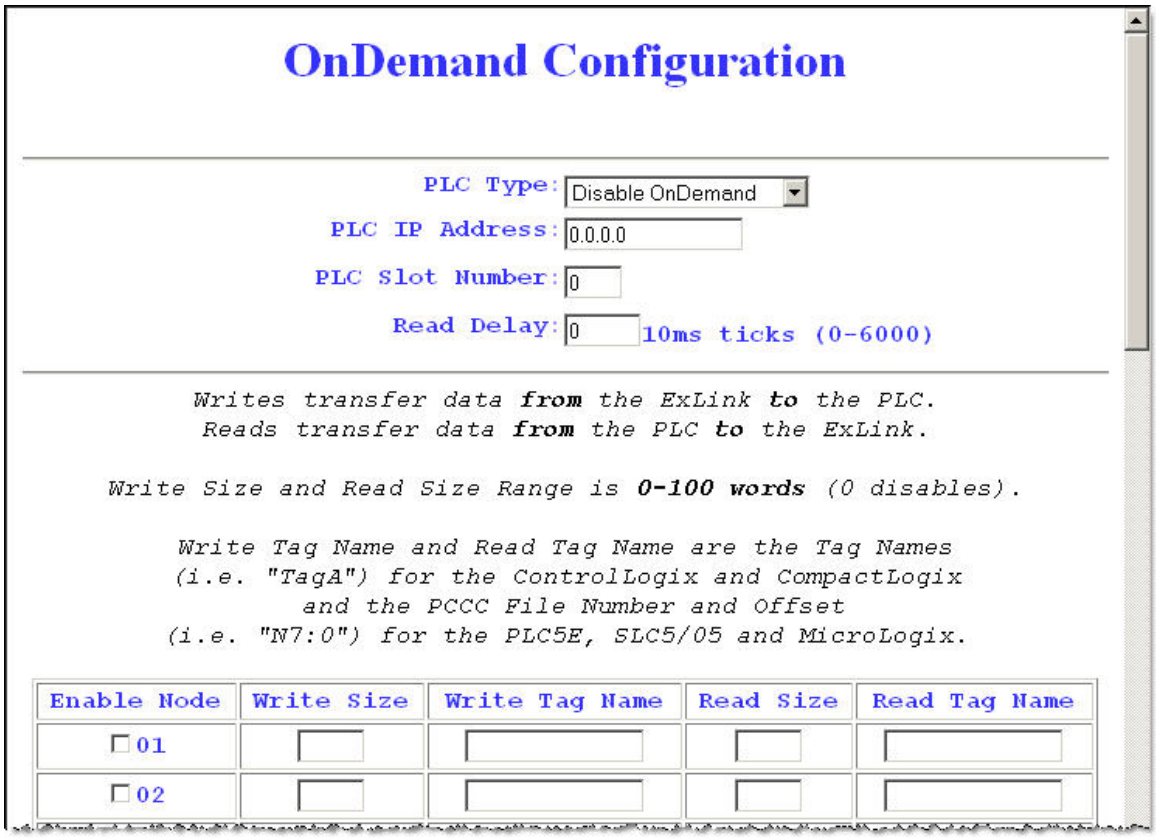

OnDemand Configuration
PLC Type: Disable OnDemand
PLC IP Address: 0.0.0.0
PLC Slot Number: 0
Read Delay: 0 10ms ticks (0-6000)
Writes transfer data from the ExLink to the PLC.
Reads transfer data from the PLC to the ExLink.
Write Size and Read Size Range is 0-100 words (0 disables).
Write Tag Name and Read Tag Name are the Tag Names
(i.e. "TagA") for the ControlLogix and CompactLogix
and the PCCC File Number and Offset
(i.e. "N7:0") for the PLC5E, SLC5/05 and MicroLogix.
Enable Node
Write Size
Write Tag Name
Read Size
Read Tag Name
01
02

Figure 49 - The OnDemand Configuration Page

3. In the upper portion of the *OnDemand Configuration Page*, select a ***PLC Type*** from the drop-down menu.

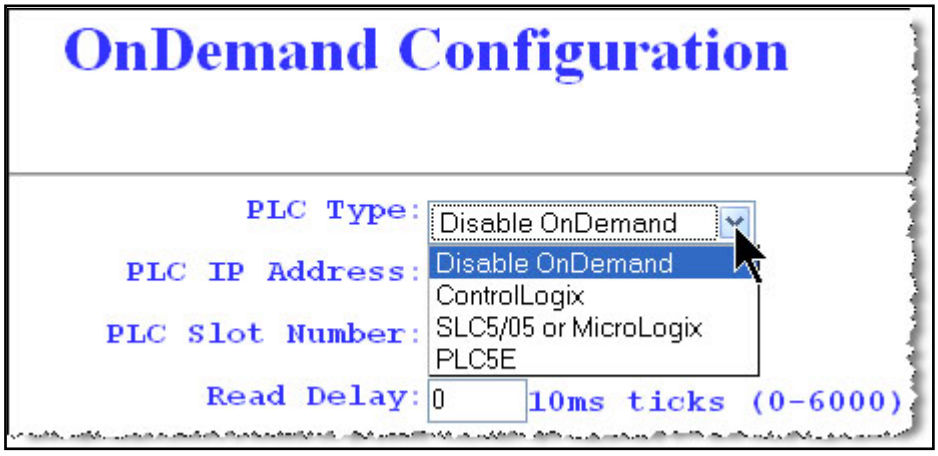


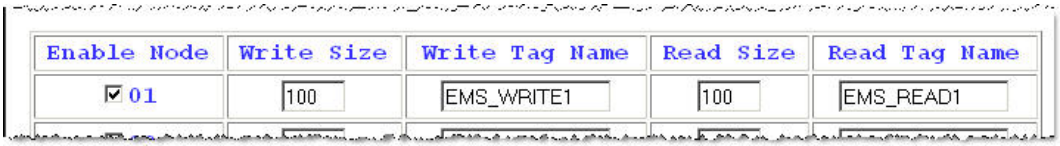
Figure 50 - The OnDemand Configuration Page

4. Enter the PLC's IP address.

5. For the ***PLC Slot Number,*** enter a value between 0 and 255. The PLC Slot Number indicates the location in your PLC rack where the controller module is installed (normally slot 0 for ControlLogix).

6. In the ***Read Delay*** field, enter a value between 0 and 6000. This number specifies (in 10ms "ticks") how frequently the BIS M-626 will poll the PLC for the presence of new data. (*Note: a value of 6000 = 60 seconds; zero = disable*).

7. In the column labeled "***Enable Node,***" place a check in the box for **Node 01.** Other Nodes listed on this page are not supported by the BIS M-626 –IND.



8. **Write Size:** Enter a value between 1 and 100 (or 0 to disable) for the ***Write Size.*** The Write Size represents the maximum number of 2-byte "words" that the BIS M-626 will attempt to write to PLC memory during a single write cycle. *(Note: to accommodate message handshaking overhead, the actual data size required by the PLC is three words larger than the value specified in this field).*

9. **Write Tag Name:** For *ControlLogix* systems, specify a ***Write Tag Name*** that is 40 characters or less (for example *EMS_WRITE1,* for Node 01). The Write Tag Name is a user defined description or title for the area of memory in the PLC where host-bound data will be written for the BIS M-626. (*Note: the Write Tag Name is not to be confused with writing to an RFID transponder, which is often referred to as "writing to a tag").*

   OR

   Write Tag Name: For *PLC5E, SLC5/05 and MicroLogix* systems, enter the ***PCCC File Number and Offset*** (for example *N7:0*) in the *Write Tag Name* field. Together these values identify the location in the PLC's Status File where host-bound data will be written for the BIS M-626.

10. **Read Size:** Enter a value between 1 and 100 (or 0 to disable) for the ***Read Size.*** The Read Size represents the maximum number of 2-byte "words" that the BIS M-626 will attempt to retrieve from PLC memory during a single read cycle. *(Note: to accommodate message handshaking overhead, the actual data size required by the PLC is three words larger than the value specified in this field).*

11. **Read Tag Name:** For *ControlLogix* systems, specify a ***Read Tag Name*** that is 40 characters or less (for example *EMS_READ1,* for Node 01). The Read Tag Name is a user defined description or title for the area of memory in the PLC from which the BIS M-626 will retrieve data.

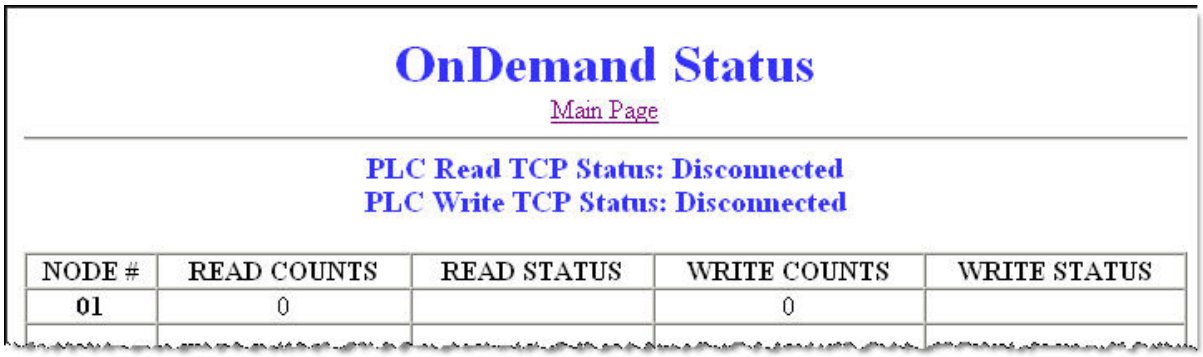
    OR

    Read Tag Name: For PLC5E, SLC5/05 and MicroLogix systems enter the ***PCCC File Number and Offset*** in the Read Tag Name field. Together these values indicate the location in the PLC's Status File from which the BIS M-626 will retrieve data.

12. After entering the proper information for Node 01, click the ***Save Settings*** button located at the bottom of the page.

The *OnDemand Status Page* will be displayed.

13. At the *OnDemand Status Page*, click the link labeled "***Main Page***" to return to the *HTTP Server – Main Page*.


OnDemand Status
Main Page
PLC Read TCP Status: Disconnected
PLC Write TCP Status: Disconnected
NODE # | READ COUNTS | READ STATUS | WRITE COUNTS | WRITE STATUS
01 | 0 | | 0 |

5.6 CONFIGURING PLC CONTROLLER TAGS

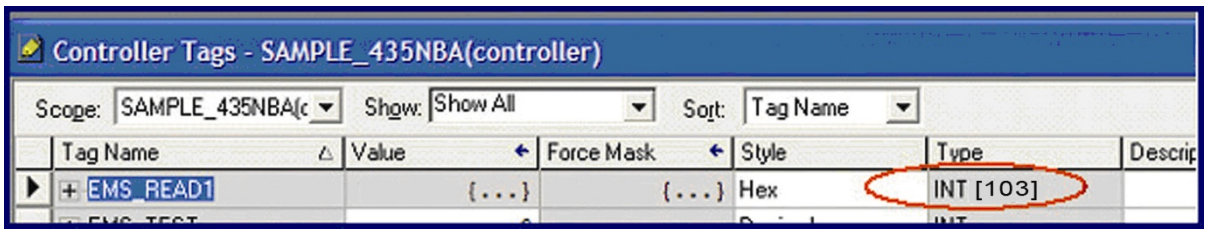
After you have configured the BIS M-626's Node via the *OnDemand Configuration Page*, open your PLC program (i.e. RSLogix 5000) and, if you have not already done so, define two ***Controller Tags*** (a ***Write Tag*** and a ***Read Tag***).

Controller Tag Naming

Controller Tags need to be assigned a name and size. Be sure to use the same ***Write Tag Name*** and ***Read Tag Name*** that you specified in the *OnDemand Node Configuration* (i.e., EMS_WRITE1 and EMS_READ1).

Controller Tag Size

Due to handshaking overhead, *Controller Tags* must have the size capacity to store an integer array equal to your previously specified ***Write/Read Size + three words***.
So for example, if the *Read Size* you specified earlier was 100 words, the corresponding *Read Tag* in the PLC must be able to store an array of 103 integers.



- The **Write Tag** holds messages and response data generated by the BIS M-626 that is bound for the host or PLC.
- The **Read Tag** holds RFID commands and instructions intended for the BIS M-626.

NOTE

The BIS M-626 should already be linked to the proper Write Tag and Read Tag via the OnDemand Utilities - OnDemand Configuration Page).

After creating and defining a *Write Tag* and a *Read Tag* for the BIS M-626, return to the BIS M-626's *HTTP Server – Main Page* to continue.

5.7 CHECKING ONDEMAND STATUS

Now that you have configured the BIS M-626's Node and defined corresponding *Write* and *Read Tags* in the PLC, the last step is to check the communication status between the BIS M-626 and the PLC.

Return to the BIS M-626's *HTTP Server - Main Page* and click the link labeled "***OnDemand Status***." The *OnDemand Status Page* will be displayed.

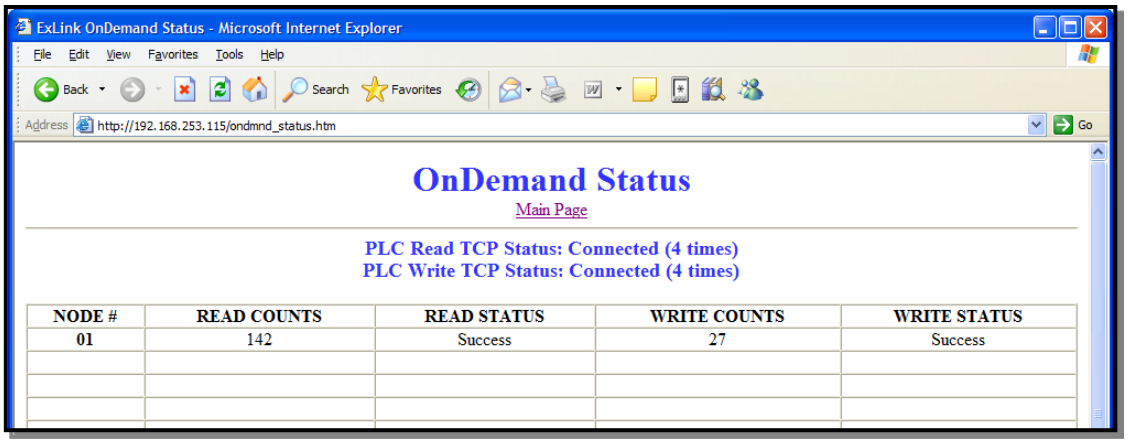

ExLink OnDemand Status - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://192.168.253.115/ondmnd_status.htm
Go
OnDemand Status
Main Page
PLC Read TCP Status: Connected (4 times)
PLC Write TCP Status: Connected (4 times)
NODE # READ COUNTS READ STATUS WRITE COUNTS WRITE STATUS
01 142 Success 27 Success

Figure 51 - The OnDemand Status Page

The OnDemand Status Page provides statistical information regarding the connection status of the BIS M-626. This information can be used to verify that read and write connections between the BIS M-626 and the PLC have been established successfully.

- ***Read Counts***: this value indicates the number of times the BIS M-626 has checked the PLC for new data.
- ***Write Counts***: this value indicates the number of times the BIS M-626 has provided data to the PLC.

NOTE

*That under Ethernet/IP, the host (and/or PLC) acts as the server. However, additional messaging instructions are not required on the part of the host because the BIS M-626 will automatically poll the Read Tag in the PLC at the interval specified by the **Read Delay** value set via the OnDemand Configuration Utility.*

There is no delay parameter when writing data to the PLC, as the BIS M-626 delivers all PLC-bound data immediately after it is generated.

If you configured a low Read Delay value, the Read Counts on the OnDemand Status Page will accumulate rapidly. This occurs because a low Read Delay value instructs the BIS M-626 to poll the PLC for new data more frequently.

CAUTION

If the BIS M-626 and PLC do not successfully establish a connection, cycle power to the BIS M-626 and verify that Ethernet/IP services are running properly on the PLC. If that does not resolve the issue, restart Ethernet/IP services on the PLC and the 1756-ENBT module.

5.8 VERIFYING DATA EXCHANGE WITH RSLOGIX 5000

At this point, communication between the BIS M-626 and the PLC should be properly configured and a connection established. You can verify the exchange of information between devices using RSLogix 5000.

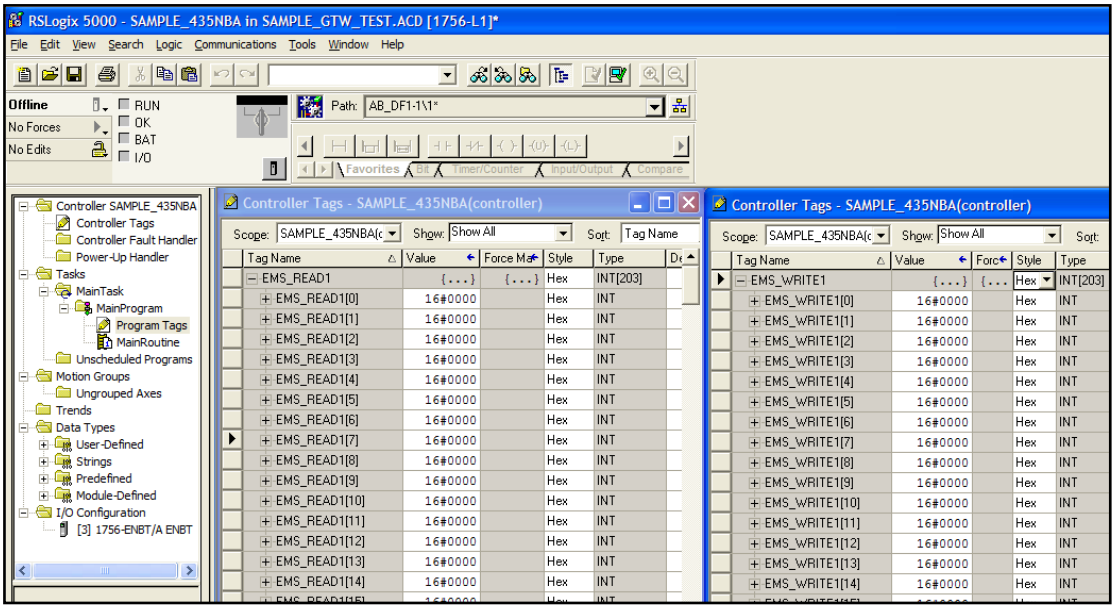


Figure 52 - RSLogix 5000

5.8.1 Ethernet/IP Handshaking

To ensure that messages to and from the BIS M-626 are properly delivered and received, a handshaking mechanism has been implemented that uses a pair of dedicated words in the exchange. The first two words in each *Controller Tag* are dedicated to handshaking.

When new information is generated, the producing device (*Data Producer*) will increment a counter in one of the *Controller Tags*. After identifying the new data, the consuming device (*Data Consumer*) will copy that same counter value to a different Controller Tag location, which lets the Data Producer know that the information has been processed by the Data Consumer.

WRITE TAG (where responses are written by the Cobalt)
EMS_Write1 [0] = (2) the Cobalt copies counter here to ACK
EMS_Write1 [1] = (3) the Cobalt increments this counter to signal response available
EMS_Write1 [2] = Data Size
EMS_Write1 [3-102] = Data
READ TAG (where commands are retrieved by the Cobalt)
EMS_Read1 [0] = (4) PLC copies the counter here to ACK the response
EMS_Read1 [1] = (1) PLC increments this counter after writing a command
EMS_Read1 [2] = Data Size
EMS_Read1 [3-102] = Data

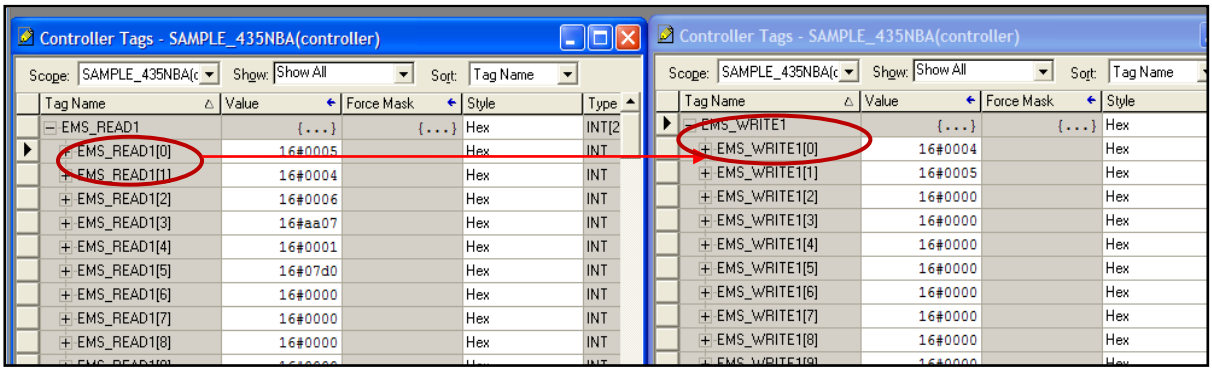
5.8.2 Ethernet/IP Handshaking Example

In the example below, **EMS_READ1** is the name of the Read Tag and **EMS_WRITE1** is the name of the Write Tag.

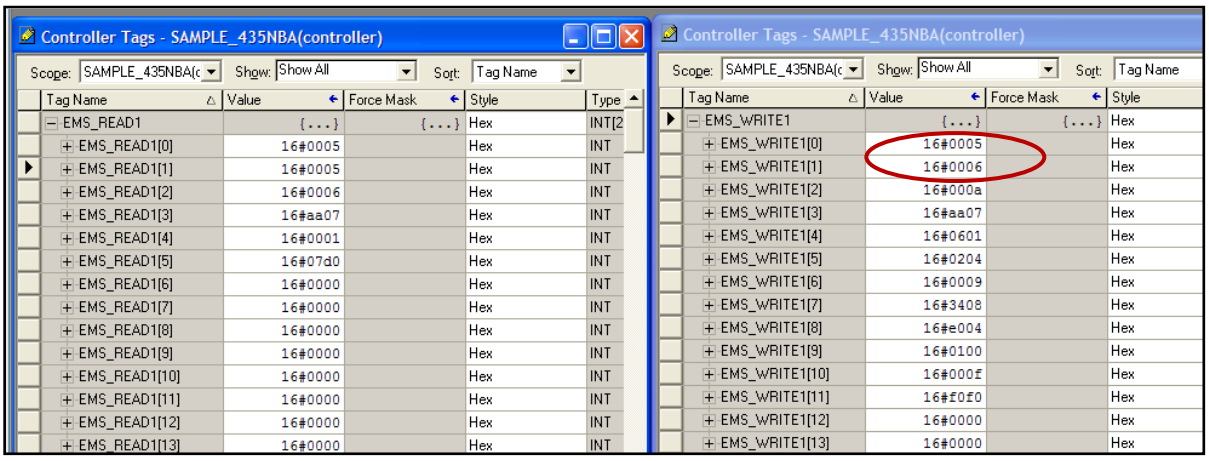
NOTE

***[0]** indicates the first word, **[1]** indicates the second word in a controller tag.*

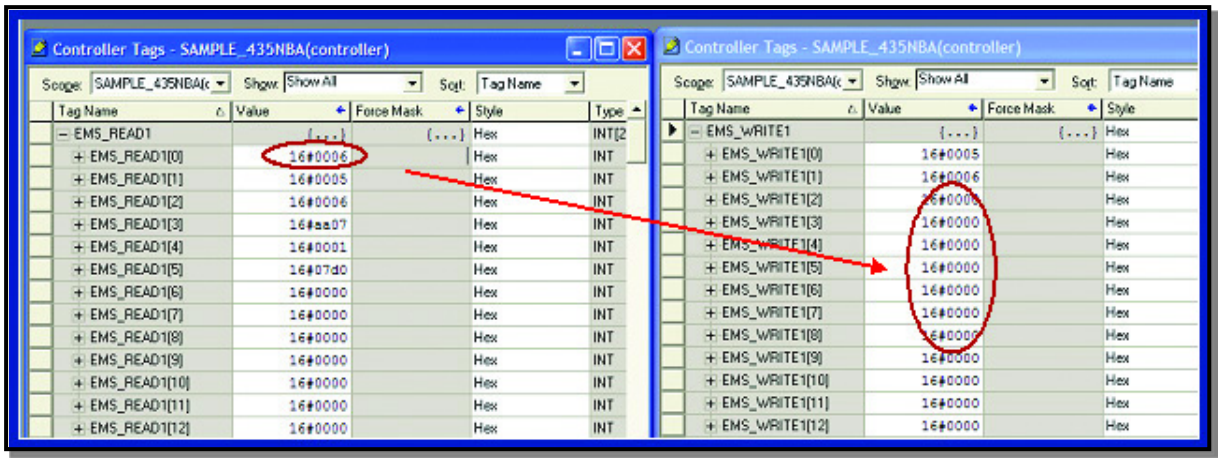
1. The PLC writes the command to the Read Tag (EMS_READ1) and then increments the counter in EMS_READ1 [1]
2. The counter in EMS_READ1 [1] is copied by the BIS M-626 to EMS_WRITE1 [0] which acknowledges that the command has been received.


Controller Tags - SAMPLE_435NBA(controller)
Scope: SAMPLE_435NBA(c Show: Show All Sort: Tag Name
Tag Name | Value | Force Mask | Style | Type
EMS_READ1 {...} {...} Hex INT[2
EMS_READ1[0] 16#0005 Hex INT
EMS_READ1[1] 16#0004 Hex INT
EMS_READ1[2] 16#0006 Hex INT
EMS_READ1[3] 16#aa07 Hex INT
EMS_READ1[4] 16#0001 Hex INT
EMS_READ1[5] 16#07d0 Hex INT
EMS_READ1[6] 16#0000 Hex INT
EMS_READ1[7] 16#0000 Hex INT
EMS_READ1[8] 16#0000 Hex INT
Controller Tags - SAMPLE_435NBA(controller)
Scope: SAMPLE_435NBA(c Show: Show All Sort: Tag Name
Tag Name | Value | Force Mask | Style
EMS_WRITE1 {...} {...} Hex
EMS_WRITE1[0] 16#0004 Hex
EMS_WRITE1[1] 16#0005 Hex
EMS_WRITE1[2] 16#0000 Hex
EMS_WRITE1[3] 16#0000 Hex
EMS_WRITE1[4] 16#0000 Hex
EMS_WRITE1[5] 16#0000 Hex
EMS_WRITE1[6] 16#0000 Hex
EMS_WRITE1[7] 16#0000 Hex
EMS_WRITE1[8] 16#0000 Hex

3. Following execution of the command, the BIS M-626 copies the response to EMS_WRITE1 (the Write Tag) and increments the counter in EMS_WRITE1 [1]. This signals that there is new data for the PLC (the BIS M-626 generated response, in this case).


Controller Tags - SAMPLE_435NBA(controller)
Scope: SAMPLE_435NBA(c Show: Show All Sort: Tag Name
Tag Name | Value | Force Mask | Style | Type
EMS_READ1 {...} {...} Hex INT[2
EMS_READ1[0] 16#0005 Hex INT
EMS_READ1[1] 16#0005 Hex INT
EMS_READ1[2] 16#0006 Hex INT
EMS_READ1[3] 16#aa07 Hex INT
EMS_READ1[4] 16#0001 Hex INT
EMS_READ1[5] 16#07d0 Hex INT
EMS_READ1[6] 16#0000 Hex INT
EMS_READ1[7] 16#0000 Hex INT
EMS_READ1[8] 16#0000 Hex INT
EMS_READ1[9] 16#0000 Hex INT
EMS_READ1[10] 16#0000 Hex INT
EMS_READ1[11] 16#0000 Hex INT
EMS_READ1[12] 16#0000 Hex INT
EMS_READ1[13] 16#0000 Hex INT
Controller Tags - SAMPLE_435NBA(controller)
Scope: SAMPLE_435NBA(c Show: Show All Sort: Tag Name
Tag Name | Value | Force Mask | Style
EMS_WRITE1 {...} {...} Hex
EMS_WRITE1[0] 16#0005 Hex
EMS_WRITE1[1] 16#0006 Hex
EMS_WRITE1[2] 16#000a Hex
EMS_WRITE1[3] 16#aa07 Hex
EMS_WRITE1[4] 16#0601 Hex
EMS_WRITE1[5] 16#0204 Hex
EMS_WRITE1[6] 16#0009 Hex
EMS_WRITE1[7] 16#3408 Hex
EMS_WRITE1[8] 16#e004 Hex
EMS_WRITE1[9] 16#0100 Hex
EMS_WRITE1[10] 16#000f Hex
EMS_WRITE1[11] 16#f0f0 Hex
EMS_WRITE1[12] 16#0000 Hex
EMS_WRITE1[13] 16#0000 Hex

4. After the PLC has processed the response information, it copies the counter from EMS_WRITE1 [1] to EMS_READ1 [0] which signals to the BIS M-626 that the PLC has retrieved the response data.



5. The data will then be cleared from EMS_WRITE1. After which the BIS M-626 will be ready to receive another command.

5.9 ETHERNET/IP: OBJECT MODEL

The ***Object Model*** is the logical organization of attributes (parameters) within classes (objects) and services supported by each device.
Objects are broken down into three categories: ***Required Objects***, ***Vendor Specific Objects*** and ***Application Objects***.

- Required Objects are classes that must be supported by all devices on EtherNet/IP. The BIS M-626 has six Required Objects.
- Vendor Specific Objects are classes that add attributes and services that do not fit into the Required Objects or Application Objects categories. The BIS M-626 has two Vendor Specific Objects.
- Application Objects are classes that must be supported by all devices using the same profile. An example of a profile is a Discrete I/O device or an AC Drive. This ensures that all devices with the same profile have a common look on the network.

Data Type Definition Table

EtherNet/IP was designed by the *Open Device Vendors Association* (**ODVA**) as an open protocol. The following table contains a description of the data types used by ODVA that are also found in this chapter.

Data Type	Description
USINT	Unsigned Short Integer (8-bit)
UINT	Unsigned Integer (16-bit)
UDINT	Unsigned Double Integer (32-bit)
STRING	Character String (1 byte per character)
BYTE	Bit String (8-bits)
WORD	Bit String (16-bits)
DWORD	Bit String (32-bits)

5.9.1 Ethernet/IP Required Objects

Under Ethernet/IP, there are **six** *Required Objects*:

- Identity Object (0x01)
- Message Router Object (0x02)
- Assembly Object (0x04)
- Connection Manager Object (0x06)
- TCP Object (0xF5)
- Ethernet Link Object (0xF6)

Identity Object (0x01 - 1 Instance)

Class Attributes

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get

Instance Attributes

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Vendor Number	UINT	50 DEC	Get
2	Device Type	UINT	0x0C	Get
3	Product Code Number	UINT	6102 DEC	Get
4	Product Major Revision Product Minor Revision	USINT USINT	01 25	Get
5	Status Word (see below for definition)	WORD	See Below	Get
6	Serial Number	UDINT	Unique 32 Bit Value	Get
7	Product Name: Product Name Size Product Name String	 USINT USINT[26]	HF-CNTL-IND-x2 06 “Cobalt”	Get

Status Word

Bit	Bit = 0	Bit = 1
0	No I/O Connection	I/O Connection Allocated
1 – 15	Unused	Unused

Common Services

Service Code	Implementation		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get Attribute Single
0x05	No	Yes	Reset

Message Router Object (0x02)

This object has no supported attributes.

Assembly Object (0x04 - 3 Instances)

Class Attributes

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	81	Get

Instance 0x64 Attributes (Input Instance)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
3	Status Information:			Get
	Bitmap of Consume Instances with Data	DINT	0	
	Bitmap of Produce Instances with Data	DINT	0	

User Datagram Protocol (UDP) I/O Sequence Number Handshaking

The data producing device increments the data sequence number by one with the transmission of each new serial data packet. Valid sequence numbers are 1-65535. After the consuming device has processed the data, it must echo the sequence number in the handshake to allow the producing device to remove the data from the queue. This is required for I/O communications because UDP is not guaranteed to arrive in order.

If the Node ID number is passed as part of the I/O message, the message is stored to the appropriate location in the Modbus RTU table. Because communications are asynchronous, the Node ID number is also stored as part of the output data. It is the responsibility of the PLC programmer to make sure the proper request lines up with the proper response if the BIS M-626 is used as a request/response device.

Instance 0x65 Attributes (Input Instance 2)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
3	Serial Produce Data:			Get
	Consume Data Seq. Number Handshake	UINT	0	
	Produce Data Sequence Number	UINT	0	
	Node 1 Serial Produce Data Size	UINT	0	
	Node 1 Serial Produce Data	WORD[100]	All 0’s	

Instance 0x66 Attributes (Input Instance 3)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
3	Serial Produce Data:			Get
	Consume Data Seq. Number Handshake	UINT	0	
	Produce Data Sequence Number	UINT	0	
	Node ID (1-32)	UINT	1	
	Node Serial Produce Data Size	UINT	0	
	Node Serial Produce Data	WORD[100]	All 0's	

Instance 0x70 Attributes (Output Instance 1)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
3	Serial Consume Data:			Get / Set
	Produce Data Seq. Number Handshake	UINT	0	
	Consume Data Sequence Number	UINT	0	
	Node 1 Serial Consume Data Size	UINT	0	
	Node 1 Serial Consume Data	WORD[100]	All 0's	

Instance 0x71 Attributes (Output Instance 2)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
3	Serial Consume Data:			Get / Set
	Produce Data Seq. Number Handshake	UINT	0	
	Consume Data Sequence Number	UINT	0	
	Node ID (1-32)	UINT	1	
	Node Serial Consume Data Size	UINT	0	
	Node Serial Consume Data	WORD[100]	All 0's	

Instance 0x80 Attributes (Configuration Instance)

Most I/O clients include a configuration path when opening an I/O connection to a server. There is no configuration data needed.

Instance 0x81 Attributes (Heartbeat Instance – Input Only)

This instance allows clients to monitor input data without providing output data.

Common Services

Service Code	Implementation		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

Connection Manager Object (0x06)

This object has no attributes.

TCP Object (0xF5 - 1 Instance)

Class Attributes

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get

Instance Attributes

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Status*	DWORD	1	Get
2	Configuration Capability*	DWORD	0	Get
3	Configuration Control*	DWORD	0	Get
4	Physical Link Object* Structure of: Path Size Path	 UINT Array Of WORD	 2 0x20F6 0x2401	Get
5	Interface Configuration* Structure of: IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name Size Domain Name	 UDINT UDINT UDINT UDINT UDINT UINT STRING	 0 0 0 0 0 0 0	Get
6	Host Name* Structure of: Host Name Size Host Name	 UINT STRING	 0 0	Get

*See section 5-3.2.2.1 – 5-3.2.2.6 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more information regarding these attributes.

Common Services

Service Code	Implementation		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get Attribute Single

Ethernet Link Object (0xF6 - 1 Instance)

Class Attributes

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get

Instance Attributes

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Interface Speed*	UDINT	100	Get
2	Interface Flags*	DWORD	3	Get
3	Physical Address*	USINT Array[6]	0	Get

*See section 5-4.2.2.1 – 5-4.2.2.3 of “Volume 2: EtherNet/IP Adaptation of CIP” from ODVA for more details on this attribute.

Common Services

Service Code	Implementation		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get Attribute Single

5.9.2 EtherNet/IP: Vendor Specific Objects

The BIS M-626 has two Vendor Specific Objects:

Vendor Specific Objects:

BIS M-626 Consume Data Object (0x64)
BIS M-626 Produce Data Object (0x65)

BIS M-626 CONSUME DATA OBJECT (0X64 - 32 INSTANCES)

Class Attributes (Instance 0)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get
2	Maximum Consume Data Buffer Size (in words)	UINT	32768	Get
3	Bitmap of Consume Instances with Data Bit 0: Instance 1 … Bit 31: Instance 32	DINT	0	Get

Instance Attributes (Instances 1-32)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Consume Data Size (in words)	UINT	0	Get / Set
2	Consume Data [0-249]	UINT	0	Get / Set
3	Consume Data [250-499]	UINT	0	Get / Set
4	Consume Data [500-749]	UINT	0	Get / Set
5	Consume Data [750-999]	UINT	0	Get / Set
6	Consume Data [1,000-1,249]	UINT	0	Get / Set
…	…	…	…	…
10	Consume Data [2,000-2,249]	UINT	0	Get / Set
…	…	…	…	…
34	Consume Data [8,000-8,249]	UINT	0	Get / Set
…	…	…	…	…
38	Consume Data [9,000-9,249]	UINT	0	Get / Set
…	…	…	…	…
42	Consume Data [10,000-10,249]	UINT	0	Get / Set
…	…	…	…	…
82	Consume Data [20,000-20,249]	UINT	0	Get / Set
…	…	…	…	…
122	Consume Data [30,000-30,249]	UINT	0	Get / Set
…	…	…	…	…
126	Consume Data [31,000-31,249]	UINT	0	Get / Set
…	…	…	…	…
130	Consume Data [32,000-32,249]	UINT	0	Get / Set
131	Consume Data [32,250-32,249]	UINT	0	Get / Set
132	Consume Data [32,500-32,249]	UINT	0	Get / Set
133	Consume Data [32,750-32,767]	UINT	0	Get / Set

Common Services

Service Code	Implementation		Service Name
	Class Level	Instance Level	
0x05	No	Yes	Reset*
0x0E	Yes	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

*This Service Code is used to flush all attributes to zero.

BIS M-626 Produce Data Object (0x65 - 32 Instances)

Class Attributes (Instance 0)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get
2	Maximum Produce Data Buffer Size (in words)	UINT	32768	Get
3	Bitmap of Produce Instances with Data Bit 0: Instance 1 … Bit 31: Instance 32	DINT	0	Get

Instance Attributes (Instances 1-32)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Produce Data Size (in words)	UINT	0	Get / Set
2	Produce Data [0-249]	UINT	0	Get
3	Produce Data [250-499]	UINT	0	Get
4	Produce Data [500-749]	UINT	0	Get
5	Produce Data [750-999]	UINT	0	Get
6	Produce Data [1,000-1,249]	UINT	0	Get
…	…	…	…	…
10	Produce Data [2,000-2,249]	UINT	0	Get
…	…	…	…	…
34	Produce Data [8,000-8,249]	UINT	0	Get
…	…	…	…	…
38	Produce Data [9,000-9,249]	UINT	0	Get
…	…	…	…	…
42	Produce Data [10,000-10,249]	UINT	0	Get
…	…	…	…	…
82	Produce Data [20,000-20,249]	UINT	0	Get
…	…	…	…	…
122	Produce Data [30,000-30,249]	UINT	0	Get
…	…	…	…	…
126	Produce Data [31,000-31,249]	UINT	0	Get
…	…	…	…	…
130	Produce Data [32,000-32,249]	UINT	0	Get
131	Produce Data [32,250-32,249]	UINT	0	Get
132	Produce Data [32,500-32,249]	UINT	0	Get
133	Produce Data [32,750-32,767]	UINT	0	Get

Common Services

Service Code	Implementation		Service Name
	Class Level	Instance Level	
0x05	No	Yes	Reset*
0x0E	Yes	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

*This Service Code is used to flush all attributes to zero.

5.9.3 Application Object (0x67 _ 10 Instances)

Class Attributes (Instance 0)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	Revision	UINT	1	Get

Instance Attributes (Instances 1-32)

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
1	**Instance Type** (0-3): 0 - Disable 1 – ControlLogix 2 – SLC 5/05 3 – PLC5E	USINT	0	Get
2	**PLC IP Address**	UDINT	0	Get
3	**PLC Slot Location** (0-255)	USINT	0	Get
11	**Max Write Size** in Words: 0 – Disabled 1 – 100 Words	UINT	0	Get
12	**Write Tag Name** (ControlLogix Only)	SHORT STRING	0	Get
13	**Write File Number** (SLC/PLC Only) **NX:0** - where **“X”** is the File Number	UINT	7	Get
14	**Write File Offset** (SLC/PLC Only) **N7:Y** - where **“Y”** is the File Offset	UINT	0	Get
15	**Write “Heartbeat” Timeout** Measured in 10ms “ticks” 0 = disabled Max value: 6000 ticks	UINT	100	Get
21	**Max Read Size** in Words 0 – Disable Max Value: 100	UINT	0	Get
22	**Read Tag Name** (ControlLogix Only)	SHORT STRING	0	Get

Attribute ID	Name / Description	Data Type	Default Data Value	Access Rule
23	**Read File Number** (SLC/PLC Only) **NX:0 -** Where **"X"** is the File Number	UINT	7	Get
24	**Read File Offset** (SLC/PLC Only) **N7:Y** - Where **"Y"** is the File Offset	UINT	0	Get
25	**Read Poll Rate** Measured in 10ms "ticks" 0 = disabled 6000 ticks max	UINT	100	Get

Common Services

Service Code	Implementation		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get Attribute Single

6 MODBUS TCP INTERFACE

NOTE

For BIS M-626-069-A01-06_ models.

One of the most popular and well-proven industrial automation protocols in use today is Modbus. Modbus is an open client/server application protocol. Modbus TCP allows the Modbus protocol to be carried over standard Ethernet networks. Modbus TCP is managed by the Modbus-IDA User Organization.

6.1 MODBUS TCP OVERVIEW

Under the Modbus TCP protocol, the BIS M-626_ acts as a Modbus Server and the PLC acts as a Modbus Client. By utilizing Produce and Consume registers for mapping commands and responses, data produced by the BIS M-626_ is consumed by the Modbus Client and data produced by the Modbus Client is consumed by the BIS M-626_.

- Modbus Client (Host or PLC) must connect to the Modbus Server (BIS M-626_) on port 502
- Maximum number of words transferred to/from an RFID tag per read/write cycle: 100 Words / 200 Bytes
- Disable any firewall services running on the PC. Firewalls can potentially block communications between the BIS M-626_ and the host and/or PLC

6.2 MODBUS TCP CONFIGURATION VIA HTTP SERVER

To configure the BIS M-626_ for Modbus TCP communications, begin by assigning the controller a locally compatible IP address.

Through a standard Web browser, you can utilize the BIS M-626_'s *HTTP Server* to access an embedded suite of controller configuration tools, called the "***OnDemand Utilities***." Among its features is the ability to modify and save changes to the controller's IP address, which is stored internally on the BIS M-626_.

BIS M-626_ Industrial Ethernet RFID Controller - Default IP Address:
192.168.253.110

Setting the BIS M-626_ IP Address

To set the BIS M-626_'s IP address using the *HTTP Server,* follow the steps below:

1. Open a Web browser on the host.
2. In the URL address field, enter the BIS M-626_'s IP address (*192.168.253.110* = *factory default)***.**
3. Press ***ENTER***.

The *HTTP Server - Main Page* will be displayed.

HTTP Server – Main Page

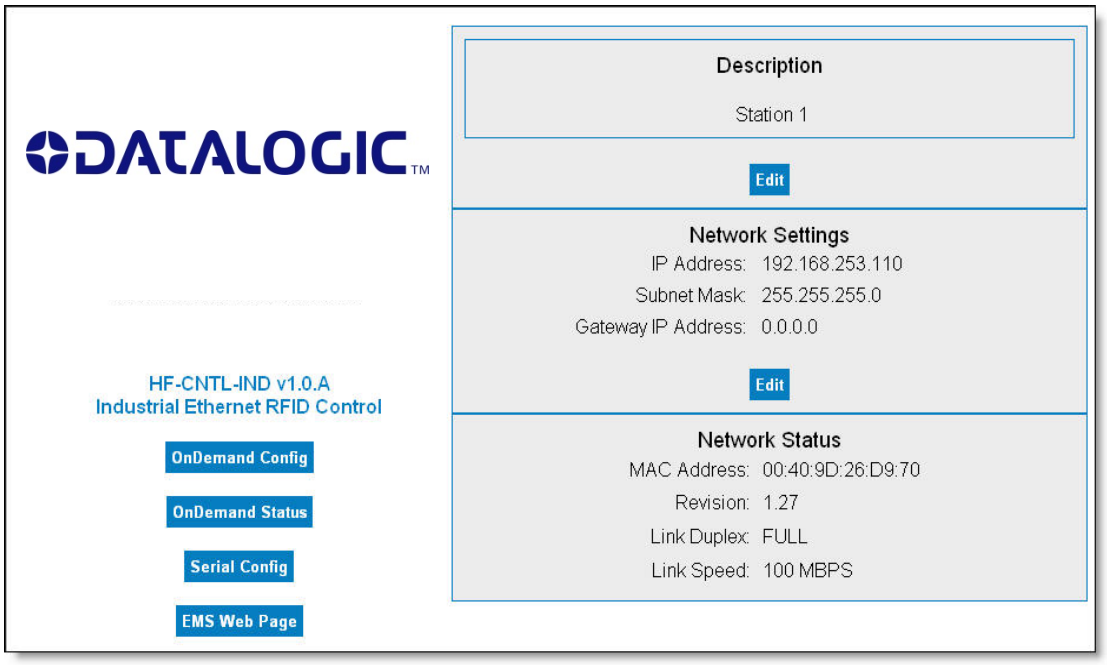
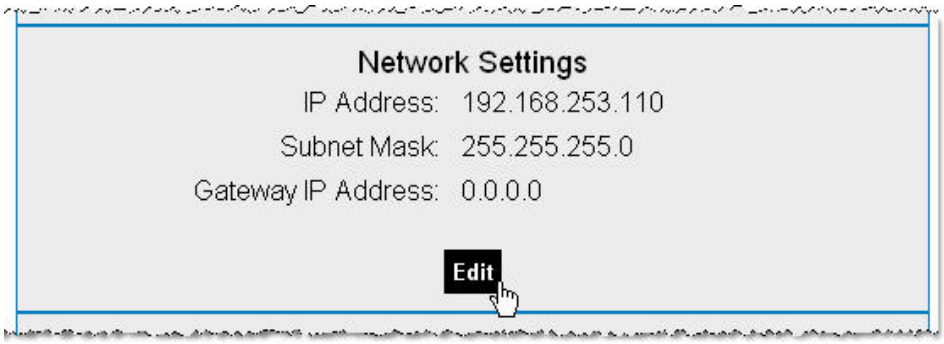


Figure 53 - The HTTP Server - Main Page

The ***HTTP Server - Main Page*** lists the network settings (including the IP address) currently stored on the BIS M-626_.

4. Click the button labeled "***EDIT***", located below "***Network Settings.***"



The IP Configuration Page will be displayed.

IP Configuration Page

The *IP Configuration Page* is used to modify and save changes to the IP Address, Subnet Mask and (Network) Gateway IP Address.

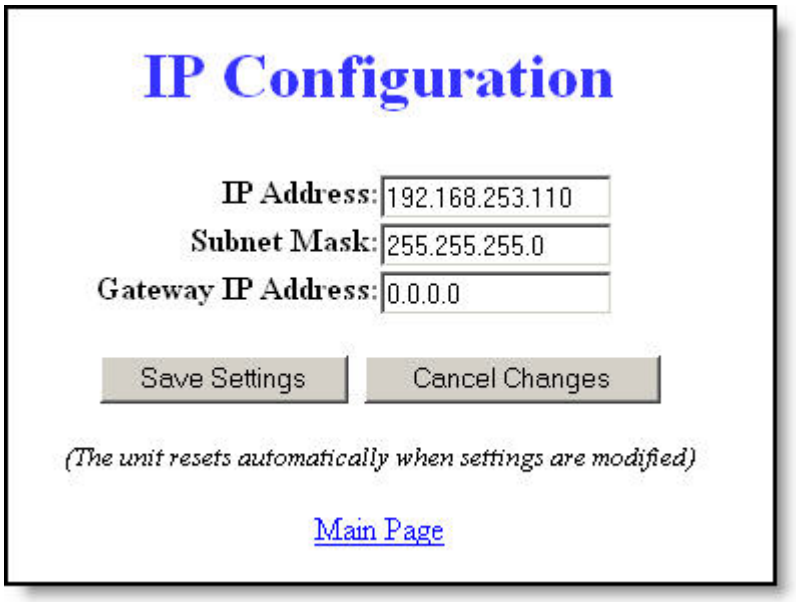


Figure 54 - The IP Configuration Page

5. In the fields provided, enter your new IP configuration values for the BIS M-626_.
6. Click the **"*Save Settings*"** button to store your new IP configuration, then cycle power to the controller to store the changes in the main memory. The Ethernet module will reset and your IP changes will be implemented.
7. After the BIS M-626_ has restarted, verify the new IP configuration by opening a Web browser and manually entering the BIS M-626_'s new IP address in the URL field. If successful, you should arrive back at the *HTTP Server – Main Page*.

6.2.1 Modbus TCP - Command Packet Structure

Consume Registers hold data that is destined for the BIS M-626_. Modbus TCP commands must be placed in the holding registers, starting at address 40001, of Device ID 01 (Node Input Page 01). Commands utilize at least six registers (double-byte values or words).

Modbus Address (4xxxx / 3xxxx)	Read / Write Privilege	Register Description
(40001) 1	R/W	2-byte Consume Data Overall Length (> 0 indicates data is available; BIS M-626_ clears to 0 after data is processed)
2	R/W	MSB = Reader Type LSB = Command ID
3	R/W	MSB = 0x00 LSB = Node ID (0x01 for the BIS M-626_)
4	R/W	2-byte Timeout Value (0-65535) measured in milliseconds
5	R/W	2-byte Start Address (0-65535)
6	R/W	2-byte Read/Block Size (0-65535 bytes)
7 – 32774	R/W	BIS M-626_ Consume Data (when applicable)
32775 – 65536	R/W	Reserved

6.2.2 Modbus TCP - Response Packet Structure

Produce Registers hold data that is destined for the host or PLC.

Modbus Address (4xxxx / 3xxxx)	Read / Write Privilege	Register Description
(40001) 1	R/W	2-byte Produce Data Overall Length (> 0 indicates data is available; Modbus Client clears to 0 after data is processed)
2	RO	MSB = Reader Type LSB = Command Echo
3	RO	Node ID Number (33 for the BIS M-626_)
4	RO	Timeout Value (0-65535)
5	RO	Read/Write Start Address (0-65535)
6	RO	Read/Block Size (0-65535 bytes)
7 – 32774	RO	BIS M-626_ Produce Data (when applicable)
32775 – 65536	RO	Reserved

6.2.3 Modbus TCP - Mapping for Node 33

Modbus Address (4xxxx)	Read / Write Privilege	Register Description
1	R/W	IP Address 1 (MSB) Example: 192
2	R/W	IP Address 2 Example: 168
3	R/W	IP Address 3 Example: 000
4	R/W	IP Address 4 (LSB) Example: 100
5	R/W	Subnet Mask 1 (MSB) Example: 255
6	R/W	Subnet Mask 2 Example: 255
7	R/W	Subnet Mask 3 Example: 255
8	R/W	Subnet Mask 4 (LSB) Example: 000
9	R/W	Gateway Address 1 (MSB) Example: 192
10	R/W	Gateway Address 2 Example: 168
11	R/W	Gateway Address 3 Example: 000
12	R/W	Gateway Address 4 (LSB) Example: 001
13	RO	MAC Address 1 (MSB) Example: 0x00
14	RO	MAC Address 2 Example: 0x40
15	RO	MAC Address 3 Example: 0x9D
16	RO	MAC Address 4 Example: 0x12
17	RO	MAC Address 5 Example: 0x34
18	RO	MAC Address 6 (LSB) Example: 0x56
19	RO	Link Status: 0 = No Link 1 = Link is OK
20	RO	Ethernet Speed (10M or 100M bits)
21	RO	Link Duplex: 0 = Half Duplex 1 = Full Duplex
22	RO	Revision (Major/Minor)
23 – 1000	R/W	Reserved
1001	RO	(Input) Data Ready Mask - Nodes 1 - 16
1002	RO	(Input) Data Ready Mask - Nodes 17 - 32
1003	RO	(Output) Data Ready Mask - Nodes 33 - 48
1004	RO	(Output) Data Ready Mask - Nodes 49 - 64
1005-10099	R/W	Reserved
10100 – 10199	R/W	Reserved
10200 – 10299	R/W	Reserved
…	…	…
13100 – 13199	R/W	Reserved
13200 – 13299	R/W	Reserved
13300 – 65536	R/W	Reserved

6.3 MODBUS TCP - HANDSHAKING

Due to the process with which commands and responses are passed between the BIS M-626_ and the host, a handshaking procedure is used to notify the host that returning data is available for retrieval.

Overall Length

The handshaking process is governed by the changing of the "***Overall Length***" value within a data packet. The Overall Length value is typically the first word (2-bytes) of a command or response and indicates the total number of data words in the packet.

Node Input and Node Output Pages

Under the Modbus TCP protocol, host-generated data is written to a pre-defined region of the BIS M-626_'s own memory known as the ***Node Input Page***. Host-bound data generated by the BIS M-626_, is written to a separate region of the BIS M-626_'s memory known as the ***Node Output Page*** (in Modbus TCP these regions of memory are called **Device IDs**). Node Input and Node Output Pages are used to temporarily hold incoming (controller-bound) and outgoing (host-bound) data.

Output Data Ready Mask

To notify the host that new data is waiting to be retrieved from the Node Output Page, the BIS M-626_ utilizes a separate 32-bit block of internal memory, called the ***Output Data Ready Mask***.
The first bit of the 32-bit Output Data Ready Mask represents the status of the Node Output Page. For example, the first or lowest bit (*bit 01*) represents Node Output Page 33 - which holds output data from Node 01.
The BIS M-626_, itself, is assigned Node 01 and thus, its corresponding Node Output Page is 33. As noted, Node Output Page 33 is represented by the first bit (*bit 01*) in the Output Data Ready Mask.

Holding Registers

When writing host-bound data to Node Output Page 33, the BIS M-626_ actually places each byte of the data packet into pre-defined "***holding registers***" within the Node Output Page. Note that a single holding register stores 2-bytes or one word of data. The 2-byte *Overall Length* value, for example, is written to the first holding register (which is location **40001)** of the Node Output Page.
Then, as the BIS M-626_ finishes writing host-bound data to the Node Output Page, the Overall Length value (stored at holding register 40001) will change from its default value of *0x00* to reflect the number of data words within the newly written host-bound data packet. This change to the Overall Length value (i.e. register 40001) within the Node Output Page, triggers the BIS M-626_ to enable (change from zero to one) bit one in the Output Data Ready Mask. It is when bit one in the Output Data Ready Mask has become enabled, that the host will recognize the pending data.
Finally, after the host has retrieved its pending data, the enabled bit in the Output Data Ready Mask and the Overall Length value at holding register 40001 of the Node Output

Page will be reset to zero (0x00), indicating that the host has received and processed its pending data.

6.3.1 Modbus TCP - Host/BIS M-626_ Handshaking

When the host issues a command, it must first write the entire command to the Node Input Page, leaving the Overall Length value to be written last.
For example, for the host to issue the 6-word command "*Read Data*," it must first write the last five words of the command to Node Input Page 01, beginning at register 40002. After which, the host will fill in the first word (at holding register 40001) with the Overall Length of the command packet.

Last Five Words of a Read Data Command

Word	MSB	LSB	Description
02	0xAA	0x05	**Command ID:** Read Data
03	0x00	0x01	**Node ID:** 0x01
04	0x03	0xE8	**Timeout Value:** 1 second
05	0x00	0x20	**Read Start Address**: 0x0020
06	0x00	0x04	**Block Size**: 4 Bytes

After writing the last five words of the command, the host will write the Overall Length value to holding register 40001 of Node Input Page 01.

First Word of a Read Data Command

Word	MSB	LSB	Description
01	0x00	0x06	**Overall Length** (*in words*)

The moment the Overall Length value (at holding register 40001) of Node Input Page 01 changes from 0x0000 to a "non-zero" value, the BIS M-626_ will recognize the waiting data and will execute the command.

6.3.2 Modbus TCP - Handshaking Example

1. The host or PLC issues an RFID command to the BIS M-626_, writing the command string to the holding registers for Device ID 01 (Node Input Page 01). An Overall Length value of 0x0006 is written last to holding register 40001.
2. The BIS M-626_ recognizes that the Overall Length value at holding register 40001 has changed for Device ID 01 (Node Input Page 01), indicating that a command is waiting to be executed.
3. The BIS M-626_ executes the command and then clears the Overall Length holding register of Device ID 01 (Node Input Page 01), setting it back the default value of zero (0x0000).

NOTE

***NOTE**: when the Node Input Page's value at register 40001 is returned to 0x0000, the host can assume that the command was at least received and execution was attempted. The host can also assume that it is OK to clear the remaining holding registers and write another command to the Device ID (Node Input Page).*

4. After the BIS M-626_ executes its given command instructions, it will write the command response to the holding registers for Device ID 33 (Node Output Page 33). Again, the Overall Length value is written last to holding register 40001.

NOTE

Host-bound data is always written to Device ID 33 (Node Output Page 33).

5. With holding register 40001 of Device ID 33 (Node Output Page 33) now containing a non-zero length value, the BIS M-626_ will enable (change from zero to 1) the first bit in the *Output Data Ready Mask*. (The first bit is allocated to Node Output Page 33).
6. Once bit 01 in the *Output Data Ready Mask* becomes enabled, the host retrieves the data string stored in the holding register area for Device ID 33 (Node Output Page 33).
7. After importing the data from Device ID 33 (Node Output Page 33), the host clears (sets back to 0x0000) the Overall Length value at holding register 40001 of Device ID 33 (Node Output Page 33). In doing so, bit 01 in the Output Data Ready Mask is also cleared.

NOTE

The clearing of bit 01 in the Output Data Ready Mask indicates to the BIS M-626_ that the host has received the response and that it is now OK to write another response to Node Output Page 33.

This completes the Modbus TCP handshaking cycle.

7 STANDARD TCP/IP INTERFACE

NOTE

For BIS M-626-069-A01-06-ST3_ models.

7.1 STANDARD TCP/IP OVERVIEW

Another means of communicating with the BIS M-626 is through the standard TCP/IP protocol. For this manual, the protocol is referred to as ***Standard TCP/IP*** to distinguish it from other industrial protocols.

In this environment, the BIS M-626 acts as the server and the host or PLC acts as client. Standard TCP/IP sessions are established between the host computer and the BIS M-626 via TCP/IP client software. A TCP/IP session generally consists of three stages: *connection setup, data transactions* and *connection termination*.
All connections to the BIS M-626 are initiated by client side software only. If, for example, an existing connection terminates unexpectedly, the BIS M-626 will not attempt to contact the client software or re-establish a connection. The client is responsible for opening, maintaining, and closing all TCP/IP sessions.

After establishing a successful connection, communications between the host and the BIS M-626 can proceed. When communication is no longer necessary, it is the responsibility of the client side application to terminate the connection.

- The TCP/IP client software (running on the host or PLC) must connect to the TCP/IP server (BIS M-626) on port 2101
- Maximum number of words transferred to/from an RFID tag per read/write cycle: 100 Words / 200 Bytes
- Disable any firewall services running on the PC. Firewalls can potentially block communications between the BIS M-626 and the host and/or PLC

7.2 STANDARD TCP/IP - IP CONFIGURATION VIA HTTP SERVER

To configure the BIS M-626 for standard TCP/IP communications, begin by assigning the controller a locally compatible IP address.

Through a standard Web browser, you can utilize the BIS M-626's *HTTP Server* to access an embedded suite of controller configuration tools, called the "***OnDemand Utilities***." Among its features is the ability to modify and save changes to the controller's IP address, which is stored internally on the BIS M-626.

BIS M-626 Industrial Ethernet RFID Controller Default IP Address:
192.168.253.110

Setting the BIS M-626 IP Address

To set the BIS M-626's IP address using the *HTTP Server,* follow the steps below:

1. Open a Web browser on the PC.
2. In the URL address field, enter the BIS M-626's IP address (*192.168.253.110* = *factory default*).
3. Press ENTER.

The HTTP Server - Main Page will be displayed.

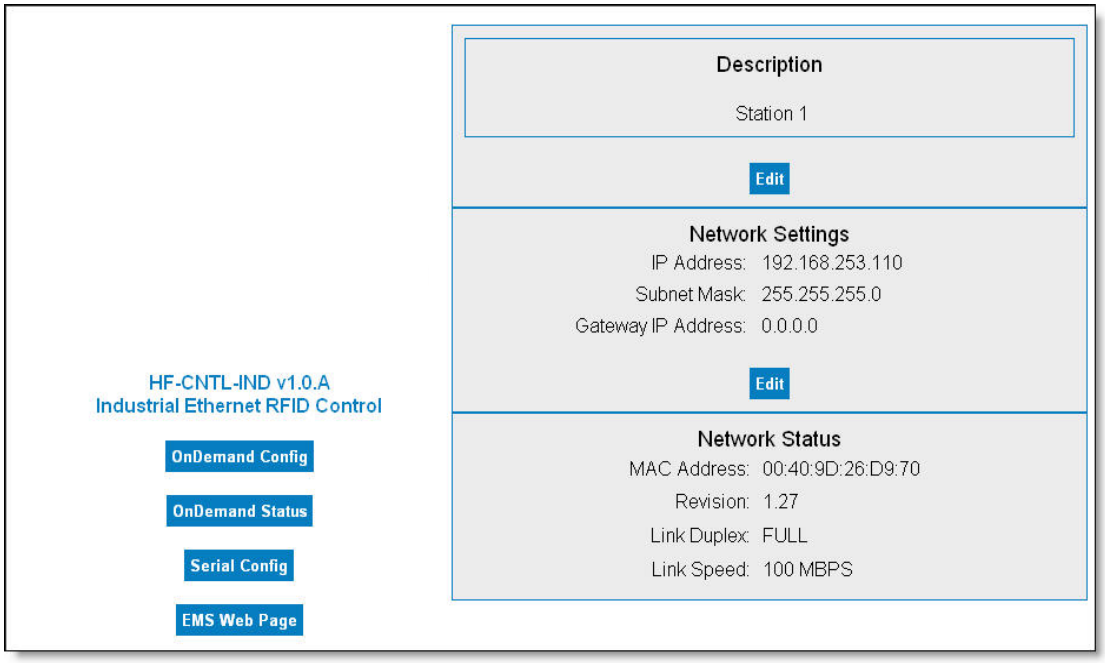
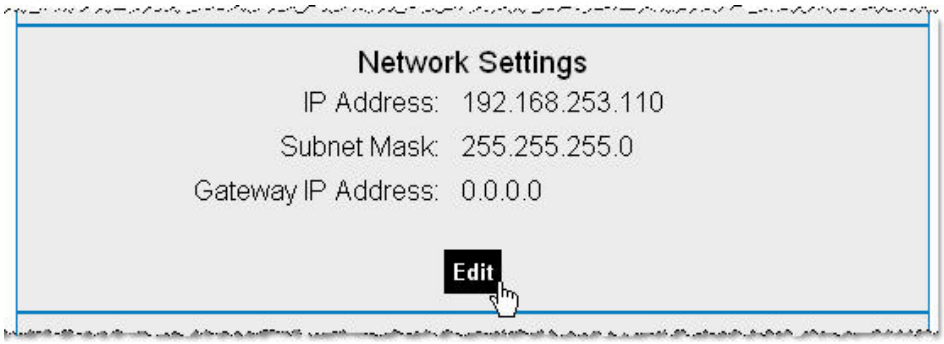


Figure 55 - The HTTP Server - Main Page

The HTTP Server - Main Page lists the network settings (including the IP address) currently stored on the BIS M-626.

4. Click the button labeled "EDIT", located below "Network Settings."



The IP Configuration Page will be displayed.

IP Configuration Page

The *IP Configuration Page* is used to modify and save changes to the IP Address, Subnet Mask and (Network) Gateway IP Address.

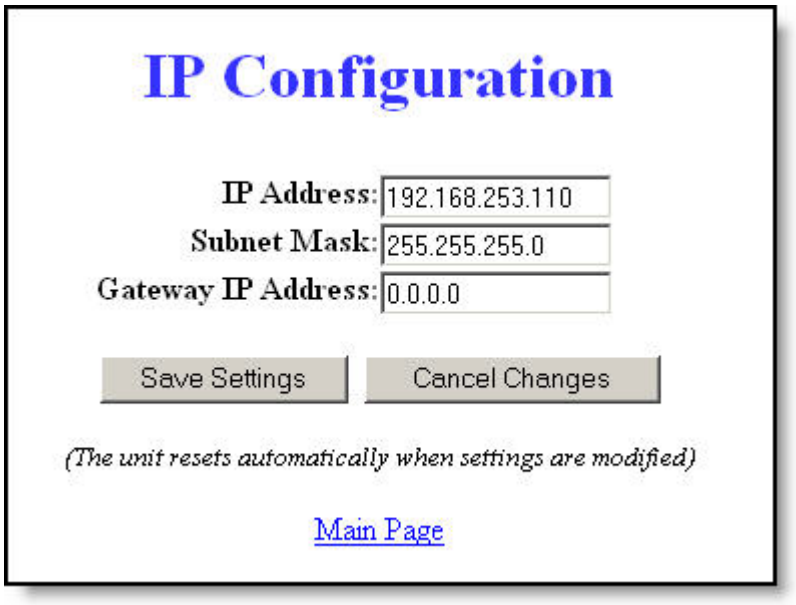


Figure 56 - The IP Configuration Page

5. In the fields provided, enter your new IP configuration values for the BIS M-626.
6. Click the **"*Save Settings*"** button to store your new IP configuration. The BIS M-626 will completely reset and your IP changes will be implemented.
7. After the BIS M-626 has restarted, verify the new IP configuration by opening a Web browser and manually entering the BIS M-626's new IP address in the URL field. If successful, you should arrive back at the *HTTP Server – Main Page*.

7.3 STANDARD TCP/IP - COMMAND & RESPONSE EXAMPLES

In standard TCP/IP, RFID commands issued by the host resemble Modbus TCP commands. The BIS M-626 handles all handshaking tasks.

Moreover, the command & response packets need an additional word at the beginning of the string:

Protocol Header 0xFF in MSB, **<Node ID>** in LSB.

Please notice that these two bytes are not considered part of the CBx command packet and should not be counted in the Overall Length.

Below is the structure of the additional word required, named as **Word # 00**:

Word #	Command Packet Element	MSB	LSB
00	**Protocol Header** in MSB: *0xFF* **Node ID** in LSB	0xFF	<Node ID>

And similarly for the response:

Word #	Response PACKET ELEMENT	MSB	LSB
00	**Protocol Header** in MSB: 0xFF **Node ID Echo** in LSB	0xFF	<Node ID Echo>

NOTE

These first two bytes will not be returned in the response packet for commands executed by Node 01.

Therefore, the command packet structure for Standard TCP/IP applications is:

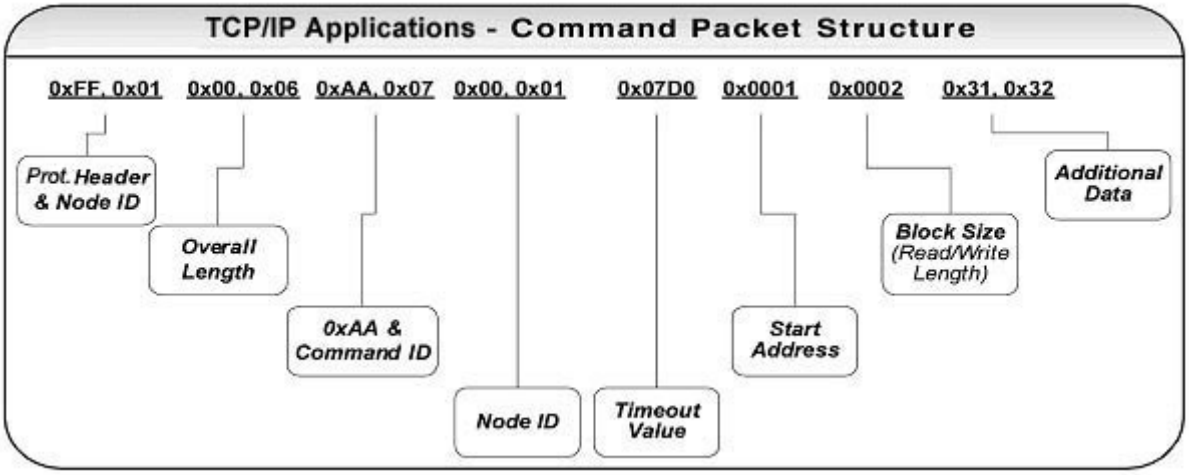


Figure 57 - Standard TCP/IP Protocol Command Packet Structure

7.3.1 Standard TCP/IP - Command Structure Example

In the following example, a 12-byte command has been issued to the BIS M-626, instructing the controller to read six bytes from a tag within RF range. A *Timeout Value* of five seconds has been set for the completion of the command.

Word	Description	MSB	LSB
00	**Protocol Header** in MSB = 0xFF **Node ID** in LSB = default value for Cobalt -IND is one (0x01)	0xFF	0x01
01	**Overall Length:** 2-byte integer indicating number of "*words*" in the command packet	0x00	0x06
02	**MSB** = 0xAA **LSB** = Command ID: (example: *0x05 – Read Data*)	0xAA	0x05
03	**MSB** = 0x00 **LSB** = Node ID: default value for Cobalt -IND is one (0x01)	0x00	0x01
04	**Timeout Value:** 2-byte integer measured in .10 ($1/10^{th}$) second increments. (*0x0032 = 50 x .10 or 5 seconds*)	0x00	0x32
05	**Start Address:** 2-byte integer identifies tag address where read will begin	0x00	0x01
06	**Block Size:** 2-byte integer indicates number of bytes to retrieve	0x00	0x06

7.3.2 Standard TCP/IP - Response Structure Example

The following resembles a typical response to the command issued in the previous example:

Word	Description	MSB	LSB
00	**Protocol Header** in MSB = **0xFF** **Node ID** in LSB = default value for Cobalt -IND is one (**0x01**)	0xFF	0x01
01	**Overall Length:** 2-byte integer indicating number of "*words*" in the response packet	0x00	0x09
02	**MSB** = 0xAA **LSB** = Command Echo: (*0x05 - Read Data)*	0xAA	0x05
03	**MSB** = Instance Counter **LSB** = Node ID: *0x01*	<IC>	0x01
04	**Time Stamp:** Month / Day (*March 19th*)	0x03	0x13
05	**Time Stamp:** Hour / Minute (*8:15 a.m.)*	0x08	0x0E
06	**MSB** = Time Stamp: Seconds **LSB** = Number of Additional Bytes Retrieved: *6*	0x00	0x06
07	**Retrieved Bytes** 1 & 2	0x61	0x62
08	**Retrieved Bytes** 3 & 4	0x63	0x64
09	**Retrieved Bytes** 5 & 6	0x65	0x66

8 DEVICENET INTERFACE

NOTE

For BIS M-623-071-A01-03-ST30 models.

8.1 DEVICENET OVERVIEW

DeviceNet is a digital, multi-drop network based on the CAN (Controller Area Network) specification, which permits easy connectivity between industrial controllers and I/O devices.

When the Controller is connected to a DeviceNet network, it is considered an individual node for which a unique Node Address number between 1 and 63 is assigned. The DeviceNet Controller conforms to the standards set by the Open DeviceNet Vendor Association (ODVA).

8.2 DEVICENET CONFIGURATION

8.2.1 Importing the Controller.EDS File

After making all necessary hardware connections, the next step in configuring the BIS M-623-071-A01-03-ST30 for DeviceNet is to import the .EDS file.

NOTE

Electronic Data Sheets (.EDS) are basic text files that are utilized by network configuration tools to identify and configure hardware devices for DeviceNet networks. A typical .EDS file contains a description of the product, its device type, hardware version and configurable parameters.*

*The .EDS file (filename: "**DeviceNet EDS.zip**") for the BIS M-623-071-A01-03-ST30 is available from the technical support area of the Balluff website.*

1. Download the .EDS file to the computer running your network's Rockwell Automation software (i.e. the host computer).
2. Using the *EDS Hardware Installation Tool,* located in the *RSLinx™ Tools* program group, import the .EDS file into your RSNetWorx/DeviceNet system. Refer to Rockwell Automation's documentation for specific instructions.
3. After you have imported the .EDS file, close and restart all Rockwell Automation programs. If you are uncertain which programs to close, cycle power to the host computer after importing the .EDS file.

8.2.2 Configuring Controller and PLC DeviceNet Communications

After importing the .EDS file and rebooting the host computer (or after restarting your Rockwell Automation software), follow the steps below to continue configuring DeviceNet network communications between the Controller and a *ControlLogix* PLC.

1. On the host computer, start RSNetWorx for DeviceNet.
2. Go online (click NETWORK and select ONLINE).

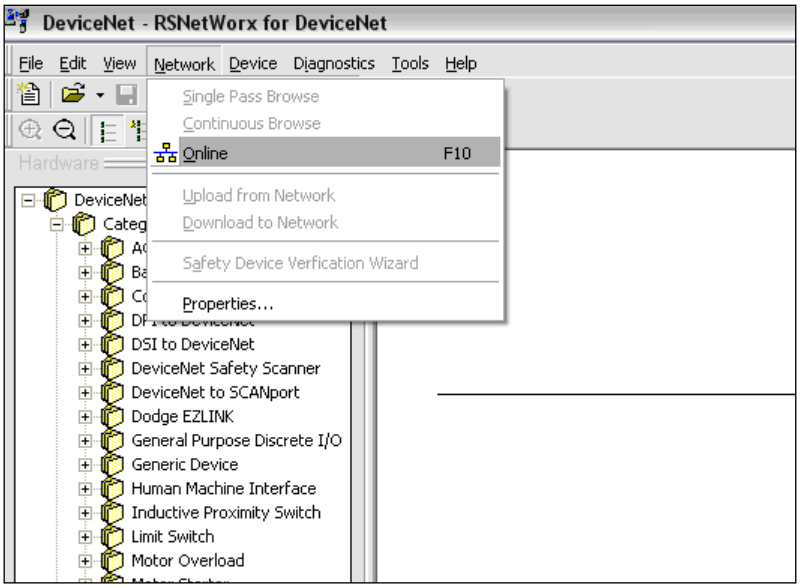
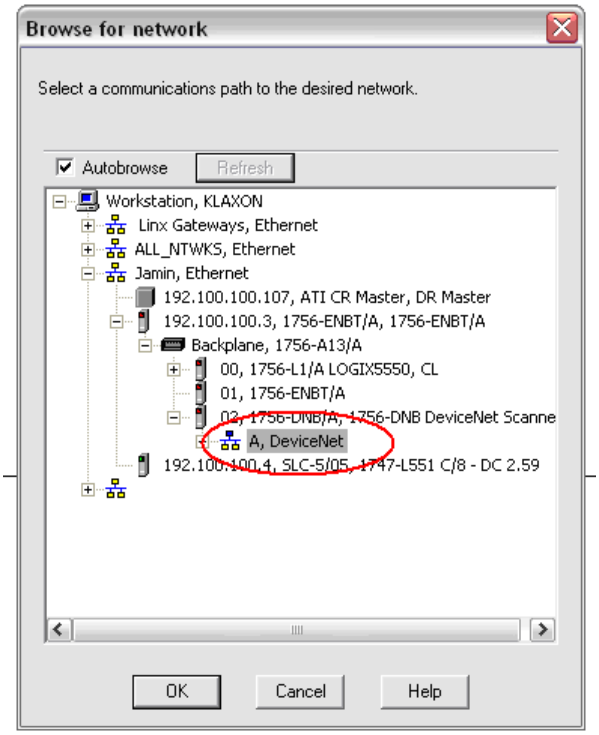


Figure 58 - Configuring Controller for DeviceNet - Going Online



3. Select the appropriate DeviceNet network and then click "***OK***."

The *Scanner Configuration Applet* in *RSNetWorx* will begin scanning the specified network. This procedure may take some time depending on the speed of the bus and the number of devices connected. Node addresses are scanned from zero to 63. The default node address for the Controller is 63.

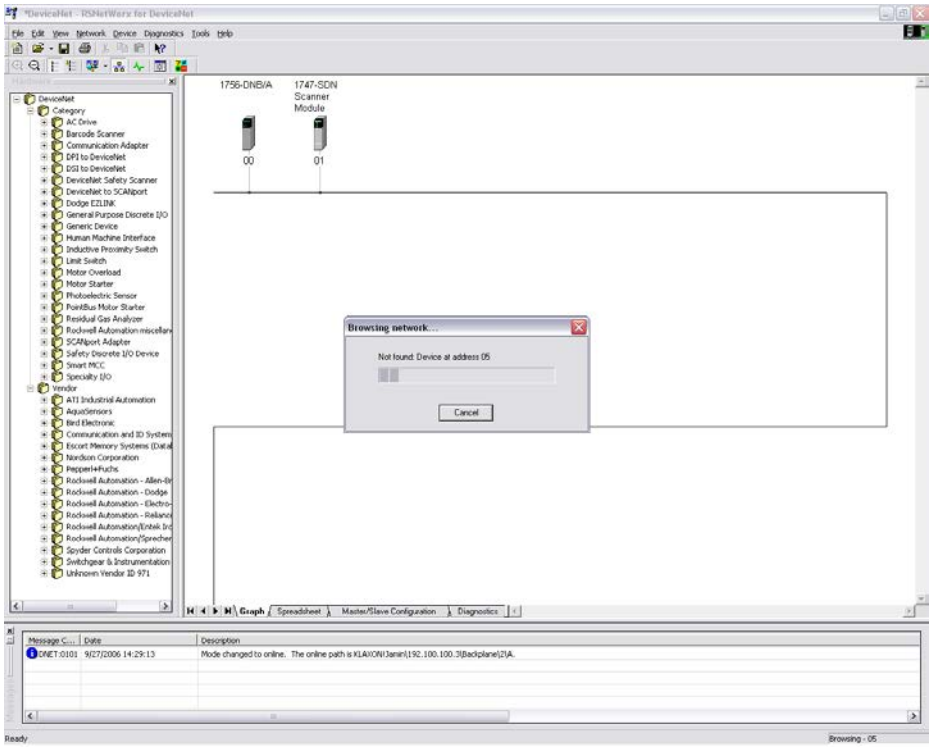


Figure 59 - Scanning Node Addresses on a DeviceNet Network

4. When the scan operation has completed, click "***UPLOAD***", in the *Scanner Configuration Applet* dialog box, to update the configuration of the *RSNetWorx* software.

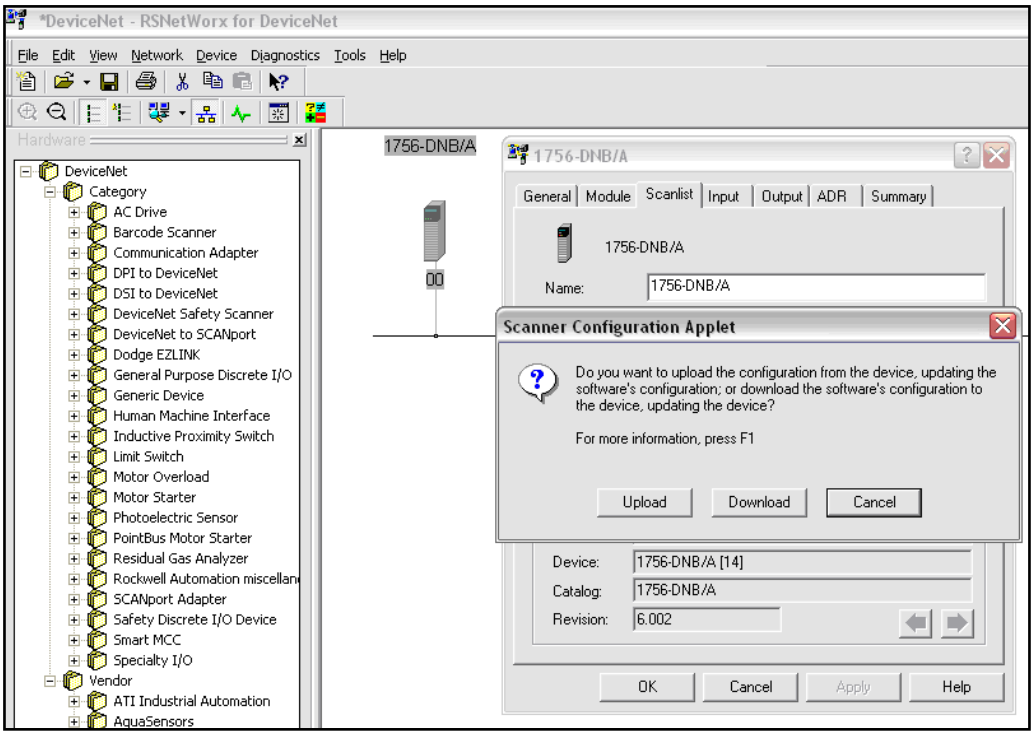
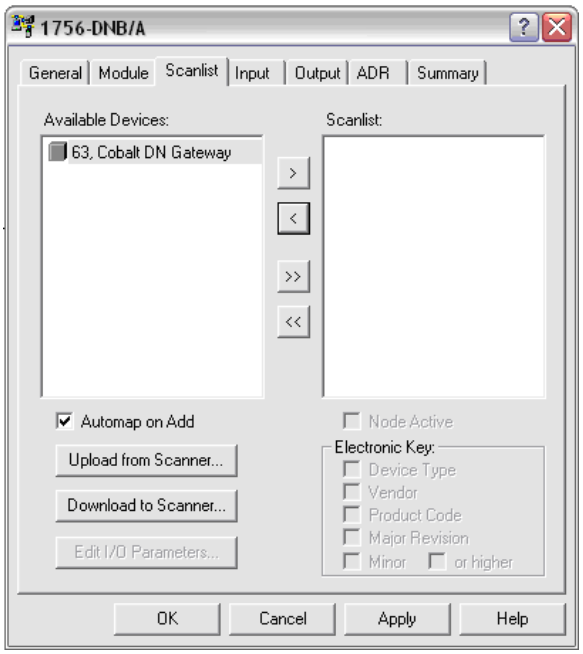


Figure 60 - Updating Configuration in RSNetWorx



NOTE

*The 1756-DNB/A is a Series A DeviceNet Bridge / Scanner Module. After updating the software, the Controller should be recognized on the network and the device name, "**63**, **Cobalt DN Controller**", should be displayed under "Available Devices."*

4. Highlight the *Controller* in the *Available Devices* list, and add it to the *Scanlist* field on the right hand side of the dialogue box. Click "***Apply***" and then "***OK***."

   The Controller will be added to the list of DeviceNet hardware in RSNetWorx.

5. Next, select the *Controller* from the list of DeviceNet hardware and edit its *I/O Parameters.* Set the *Input Size* and *Output Size* parameters according to your application requirements, then click "***OK.***" In the example below, 30 input bytes and 30 output bytes will be scanned per polling cycle.

NOTE

Strobed mode is not supported by the BIS M-623-071-A01-03-ST30.

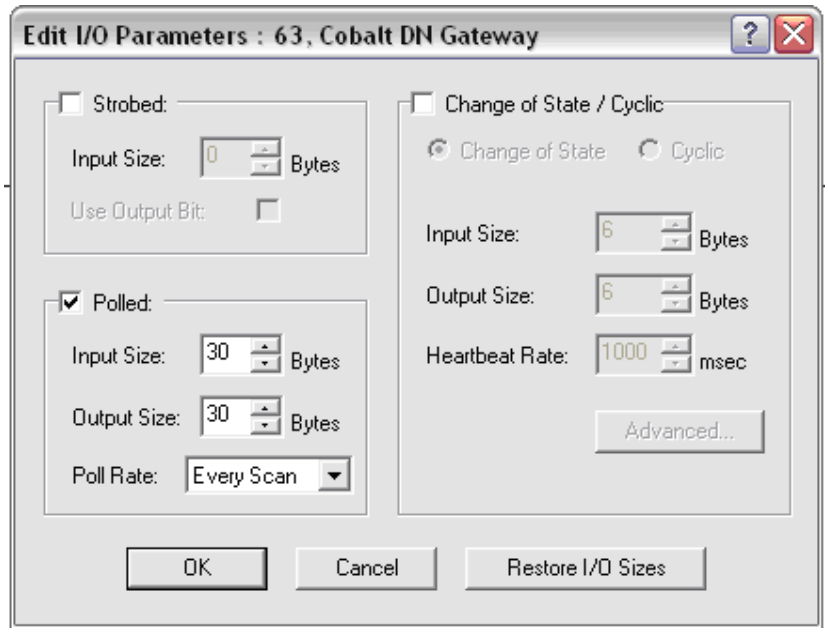


Figure 61 - Editing the Controller's DeviceNet I/O Parameters

The following images display the **Input** and **Output** properties tabs (in *RSNetWorx for DeviceNet)* for the *1756-DNB/A DeviceNet Bridge / Scanner Module* after running the *Scanner Configuration Applet* for a second time. The scanner module, in this case, only identified one node, the Controller, at node address 63. The tabs are used to identify where input and output data is mapped for each identified node. In the image below, input data is mapped to start at **1:I.Data(0).0** on the PLC.

6. Run the *Scanner Configuration Applet* and verify the mapping of the address where the PLC will write input data for the Controller.

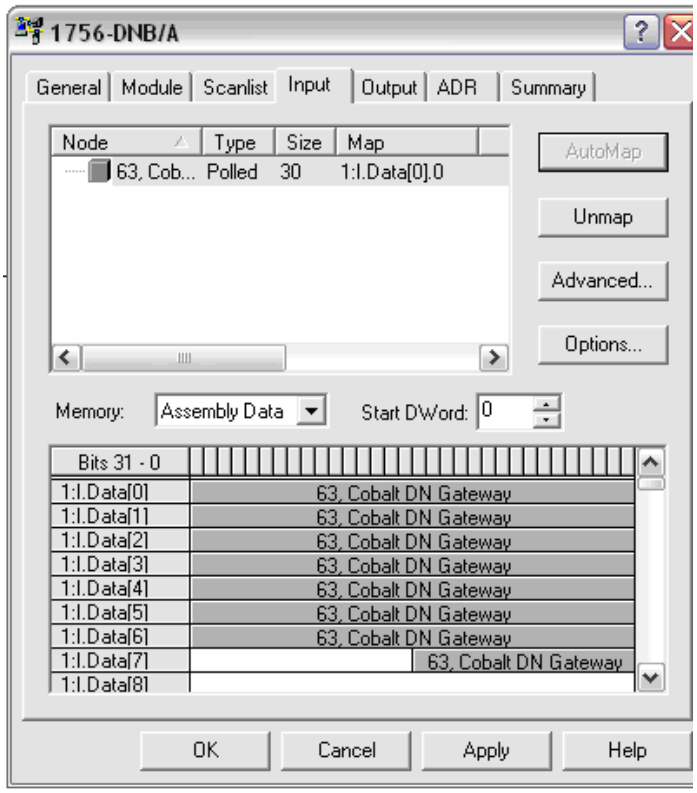


Figure 62 - 1756-DNB/A Input Properties Tab

7. Next, verify the mapping of the address where the PLC will retrieve output data from the Controller. In the image below, output data is mapped to start at **1:O.Data(0).0** on the PLC.

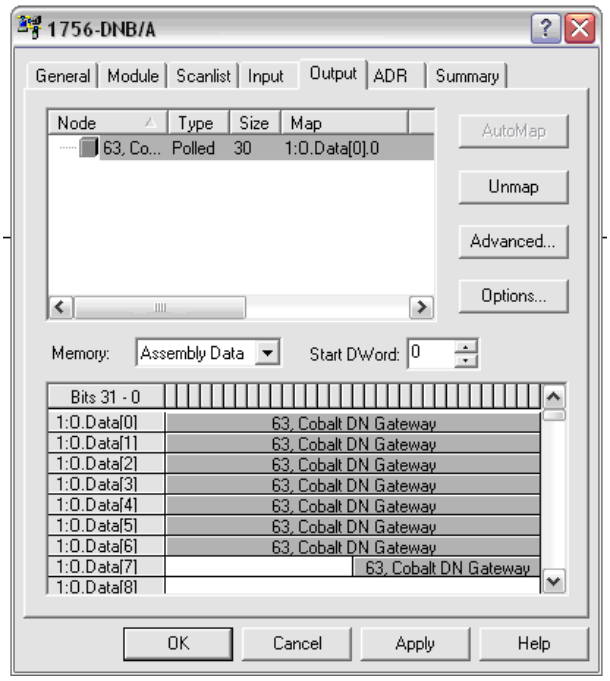


Figure 63 - 1756-DNB/A Output Properties Tab

8. Lastly, click "***Apply***" and select "***YES***" to download the configuration and mapping settings from *RSNetWorx* to the PLC.

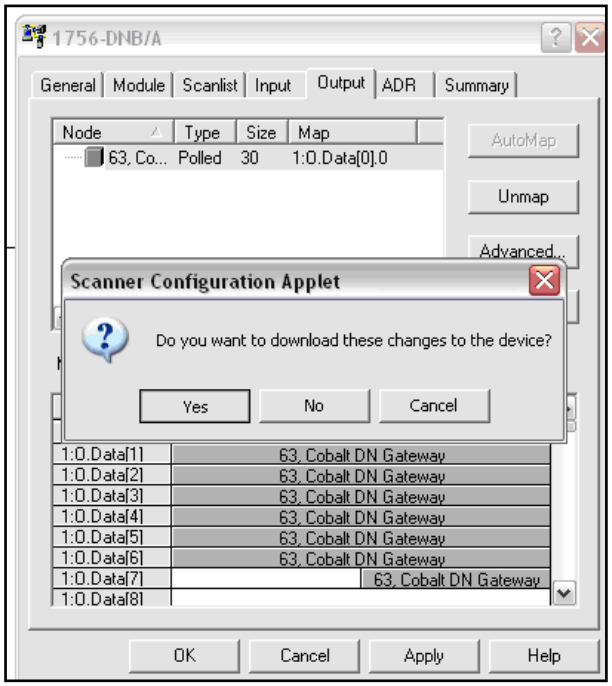


Figure 64 - 1756-DNB/A Output Properties Tab

8.2.3 Configuring Data Rate and Node Address

As noted, each device, computer and controller on a DeviceNet network is considered an individual node for which a unique *Node Address* number (between 0 and 63) is assigned. The node address provides a means of numerically identifying each device on a DeviceNet network.

Prior to operating the BIS M-623-071-A01-03-ST30 , you must verify that it has been configured for the same Data Rate as your network and that it has been assigned a suitable node address value. The Controller supports data rates of 125Kb (default), 250Kb and 500Kb and supports node addresses 1 – 63 (default: 63).

To change the data rate or node address, use either the "*Node Commissioning*" tool in *RSNetWorx for DeviceNet* or the “Balluff Dashboard™” utility running on a host computer that is connected to the RS232 port on the Controller. The *Balluff Dashboard*™ utility is available on the Balluff Web site (www.balluff.com).

NOTE

When using node commissioning in RSNetWorx for DeviceNet, modify only one parameter at a time (either data rate or node address). After changing the data rate, you must manually cycle power to your DeviceNet network for the change to take effect.

Factory Default Configuration**:**

Data Rate = 125Kb

Node Address = 63

8.2.4 DeviceNet - Exchanging Data and Handshaking

After the Controller has been properly configured for your DeviceNet network, it will be possible to send the Controller commands using the Balluff **CBx Command Protocol**. For reference, the CBx Command Protocol Reference Manual is available on the Balluff Web site (www.balluff.com).

However, to ensure that messages to and from the Controller are properly delivered and received, a handshaking mechanism has been implemented that uses a pair of dedicated words in the exchange.

The first two words in the *Input Controller Tag* and *Output Controller Tag* are dedicated to handshaking. When new information is generated, the data-producing device increments the counter value stored in the second word of a controller tag (either Input or Output, depending on the device). The data-consuming device, copies that same value to the counter in the first word of the reciprocal (or opposite) controller tag. This handshaking scheme signals to the data producer that the information has been received.

The image below displays an example of the data contained in the two I/O Controller Tags for the Controller.

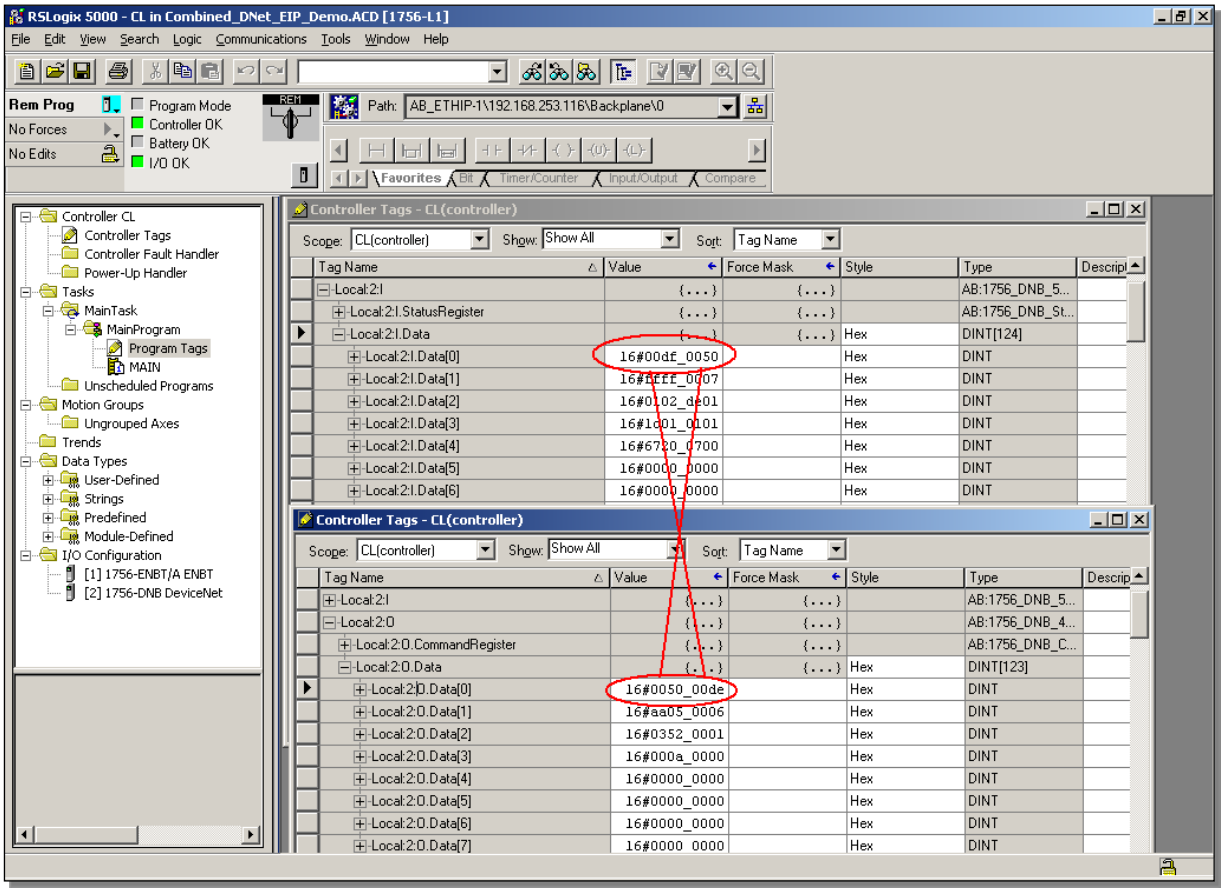


Figure 65 - Controller I/O Controller Tags (in RSLogix 5000)

8.2.5 DeviceNet - Handshaking Example

This example describes the sequence of events for a simple command and response. All data is written in 2-byte *WORD* format and stored in 2-byte "*registers.*"
The ***Output Controller Tag*** holds command data written by the PLC. The ***Input Controller Tag*** holds response data generated by the Controller. Handshaking is implemented using the first two words (*Words 0 and 1*) in both *Input Controller Tag* and *Output Controller Tags*.

The PLC writes a command to the *Output Controller Tag*, starting with the 2-byte *Consume Data Size* value at **Local:2:O.Data [2]** (which is the third register of the *Output Controller Tag*). The remainder of the command packet is then written, 2-byte per register, to the *Output Controller Tag,* starting at the fourth register, **Local:2:O.Data [3].** After writing the command packet data to the appropriate registers, the PLC increments the counter value stored at **Local:2:O.Data [1]** (the second register in the *Output Controller Tag*).

The counter at **Local:2:O.Data [1]** is copied by the Controller to **Local:2:I.Data [0]** (the first register of the *Input Controller Tag*) which signals the PLC that the command has been received by the Controller.

Following execution of the command, the Controller writes its response to the *Input Controller Tag,* starting with the 2-byte *Produce Data Size,* at **Local:2:I.Data [2]** and the actual data beginning at **Local:2:I.Data [3]**. It then increments the counter value at **Local:2:I.Data [1]**. This alerts the PLC to the new data available (the Controller generated response, in this case).

After processing the response information, the PLC copies the counter from **Local:2:I.Data [1]** to **Local:2:O.Data [0]**, which signals to the Controller that the PLC has retrieved the response data.

OUTPUT CONTROLLER TAG

Controller Tag Location and Data	Description
Local:2:O.Data [0]	(4) The PLC copies the value at **2:I:Data[1]** here to acknowledge receipt of the response
Local:2:O.Data [1]	(1) The PLC increments this counter value after copying a command in Consume Data
Local:2:O.Data [2]	Consume Data Size
Local:2:O.Data [3]	First WORD of Consume Data (*Command from PLC*)
Local:2:O.Data [xxx]	xxx WORD of Consume Data

INPUT CONTROLLER TAG

Controller Tag Location and Data	Description
Local:2:I.Data [0]	(2) The value at **2:O:Data[1]** is copied here by the Controller to acknowledge receipt of a command
Local:2:I.Data [1]	(3) The Controller increments this counter to signal that a response is available
Local:2:I.Data [2]	Produce Data Size
Local:2:I.Data [3]	First WORD of Produce Data (*Response from Controller*)
Local:2:I.Data [xxx]	xxx WORD of Produce Data

NOTE: A ladder logic example illustrating the implementation of this handshaking strategy can be downloaded from the technical support area of the Balluff website.

9 PROFIBUS INTERFACE

NOTE

For BIS M-622-070-A01-03-ST33 models.

9.1 PROFIBUS OVERVIEW

Profibus was created under German Government leadership in co-operation with automation manufacturers (Siemens) in 1989. Today it is commonly found in Process Control, large assembly and material handling machines. Just a single-cable which is able to wire multi-input sensor blocks, pneumatic valves, complex intelligent devices, smaller sub-networks, operator interfaces and many other devices.

9.2 PROFIBUS-DP

Basically Profibus is available in three different versions:

Profibus-DP (Decentralized Periphery)
Multiple masters are possible with Profibus-DP, in which case each slave device is assigned to one master. This means that multiple masters can read inputs from the device but only one master can write outputs to that device.

Profibus-FMS
It is a peer to peer messaging format, which allows masters to communicate with one another. Just as in Profibus-DP, up to 126 nodes are available and all can be masters if desired. FMS messages consume more overhead than DP messages.

Profibus-PA
PA protocol is the same as the latest Profibus-DP except that voltage and current levels are reduced to meet the requirements of intrinsic safety (Class I div. II) for the process industry.

The Profibus Processor unit supports **Profibus-DP only**, since this version has been specifically designed for factory automation.

MAIN FEATURES:

Maximum Number of Nodes: 126

Distance: 100 m to 24 Km (with repeaters and fibre optic transmission)

Baud rate: 9600 to 12M bps

9.3 DATA EXCHANGE

The Master Profibus is usually a PLC (Siemens S7 or others) but it could be a PC based device as well. The Profibus Processor unit is always Slave in the Profibus network.

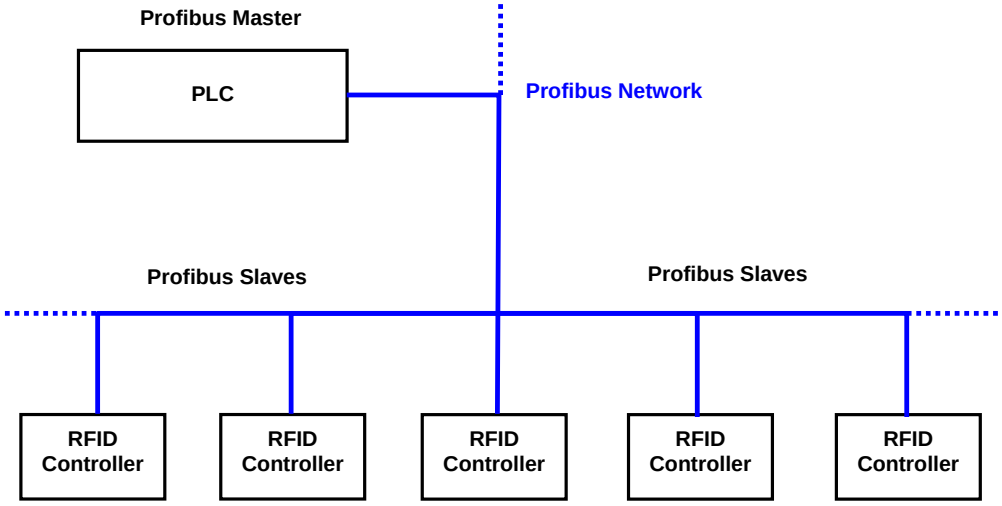


Figure 66 - Profibus-DP Network Diagram

Basically two shared memory areas (Exchange Areas) are used to exchange information between the SLAVE and the MASTER, both devices provide information to each other.

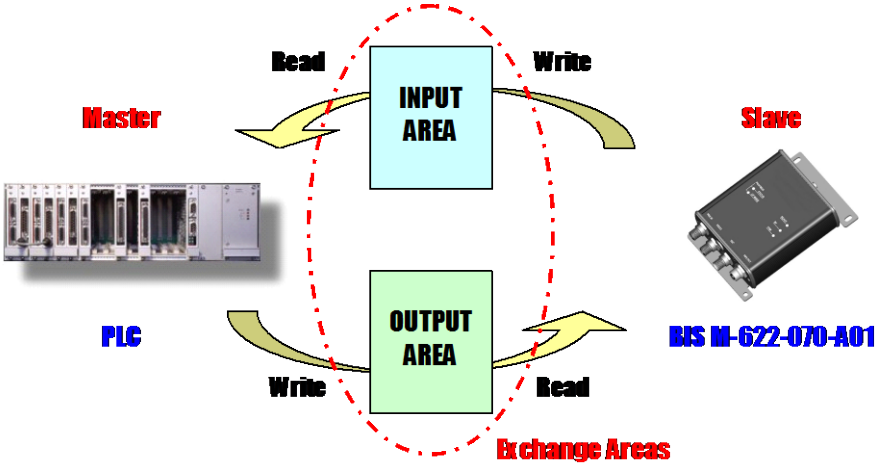


Figure 67 - Profibus Communication – Data Exchange Areas Diagram

Input and Output areas always refer to the Master: this means that the Processor unit writes to the Input buffer and the PLC writes to the Output buffer.

The dimension of the exchange areas can be set to different values by the PLC through the GSD file: the Profibus Processor unit allows up to **152 bytes as a combined total of the Input and Output Areas**.

NOTE	*For further information regarding Fieldbus interfacing including downloadable support files, go to the HMS website at http://www.anybus.com, choose the link to the support page, select the* Anybus-CompactCom product type *and then your* network type.

9.4 PROTOCOL IMPLEMENTATION

9.4.1 Definitions

In the protocol description we'll use the following definitions:

- Input field: is the set of master inputs that can be modified by the specific slave
- Output field: is the set of master outputs that can be read by the specific slave
- MaxInBytes: is the number of input bytes shared by the master and the specific slave
- MaxOutBytes: is the number of output bytes shared by the master and the specific slave
- IN[Nin] represent the input byte number Nin, where numbering starts from 0 to MaxInBytes-1
- OUT[Nout] represent the output byte number Nout, where numbering starts from 0 to MaxOutBytes-1

Obviously, MaxInBytes and MaxOutBytes are respectively the configured **INPUT** and **OUTPUT AREA** sizes.

The I/O Exchange Areas are actually updated and read every 30 ms at the Profibus Processor unit side. So after an RFID tag is read the worst delivery time from the Profibus Processor unit to the Master station is about 30 ms plus the intrinsic PROFIBUS DP delay and the Master delay.

This product implements the Balluff AnyBus Protocol which is a layer that is built upon the intrinsic fieldbus data exchange mechanism. The Driver is needed to add features such as flow control and fragmentation.

In order to implement the flow controlled version of the driver, I/O Exchange Areas must be congruently compiled in both directions. **INPUT** Area is the Exchange buffer from Profibus Processor unit to the Master while **OUTPUT** Area is the exchange buffer from the Master to the Profibus Processor unit. Only the first three bytes are used by the Balluff AnyBus Protocol layer in both buffers for the extended protocol.

These are:

byte 0: **Control Field**, used to issue and control the Balluff AnyBus Protocol primitives such as flowcontrol, fragmentation and resynchronization;

byte 1: **Service Access Point Field**, used to distinguish among different services but also to provide future expandability. Since this SAP definition is introduced by the Balluff AnyBus Protocol, it must not be confused with the AnyBus SAP that is defined by the international standard.

byte 2: **Length Field**, that contains the number of bytes used by the application layer. This number must always be less than or equal to MaxInBytes-3 for the IN[ ] buffer and less than or equal to MaxOutBytes-3 for the OUT[ ] buffer.

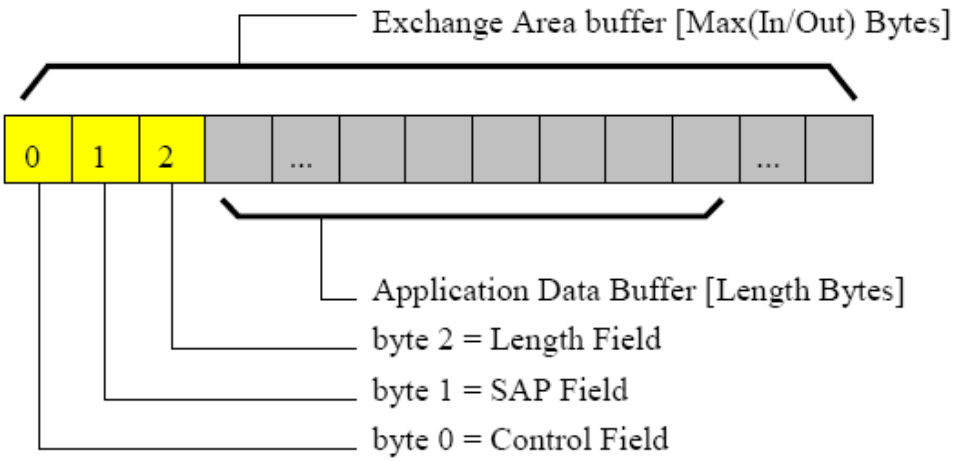


Figure 68 - Exchange Area Buffer Structure

9.4.2 Control Field

The Input field structure reserves IN[0] for handshake purposes: bit 0 and bit 1 are used for this. Bit 6 is set to 1 in order to specify the messaging protocol number 1 is in use. The Output field structure is symmetrical, and reserves bit 0 and 1 for handshake purposes. Bit 6 is set to 1 in order to specify the messaging protocol number 1 is in use. Bit 2 of the Output buffer is used to request a clear of the synchronization numbers (bit 0 and bit 1 of both Input and Output buffers).

This is called a resynchronization request and it is always initiated by the Master Station. The Slave must acknowledge the request, using bit 2 of the Input buffer. Bit 3 is used to control a fragmentation sequence in both directions.

More precisely,

<u>function of the IN[0] byte:</u>

IN[0].bit0 = TxBufferFull, toggles when new data is available on IN[1] .. IN[Nin] input area

IN[0].bit1 = RxBufferEmpty, toggles when rx block has been read on OUT[1] .. OUT[Nout]

IN[0].bit2 = Resync Acknowledge, set to 1 as an acknowledge to a resync request.

IN[0].bit3 = More Bit, it must be set to 1 when this is not the last piece of a fragmentation sequence. It must be set to 0 when this is the last piece of a fragmentation sequence.

IN[0].bit4,5,7 = set to 0,0,0 when this messaging protocol is used.

IN[0].bit6 = set to 1 when this messaging protocol is used.

function of the OUT[0] byte:

OUT[0].bit0 = TxBufferEmpty, toggles when transmitted data block has been read from master.

OUT[0].bit1 = RxBufferFull, toggles when new data block is available from master.

OUT[0].bit2 = Resync Request, set to 1 for 1 second to resynchronize a slave. After

resynchronization, all 4 handshake bits are set to 0 and next toggle brings them to 1.

OUT[0].bit3 = More Bit, it must be set to 1 when this is not the last piece of a fragmentation sequence. It must be set to 0 when this is the last piece of a fragmentation sequence.

OUT[0].bit4,5,7 = set to 0,0,0 when this messaging protocol is used.

OUT[0].bit6 = set to 1 when this messaging protocol is used.

The following figure shows how it is possible to exchange messages with flow control using bit 0 and bit 1 in the IN/OUT buffers.

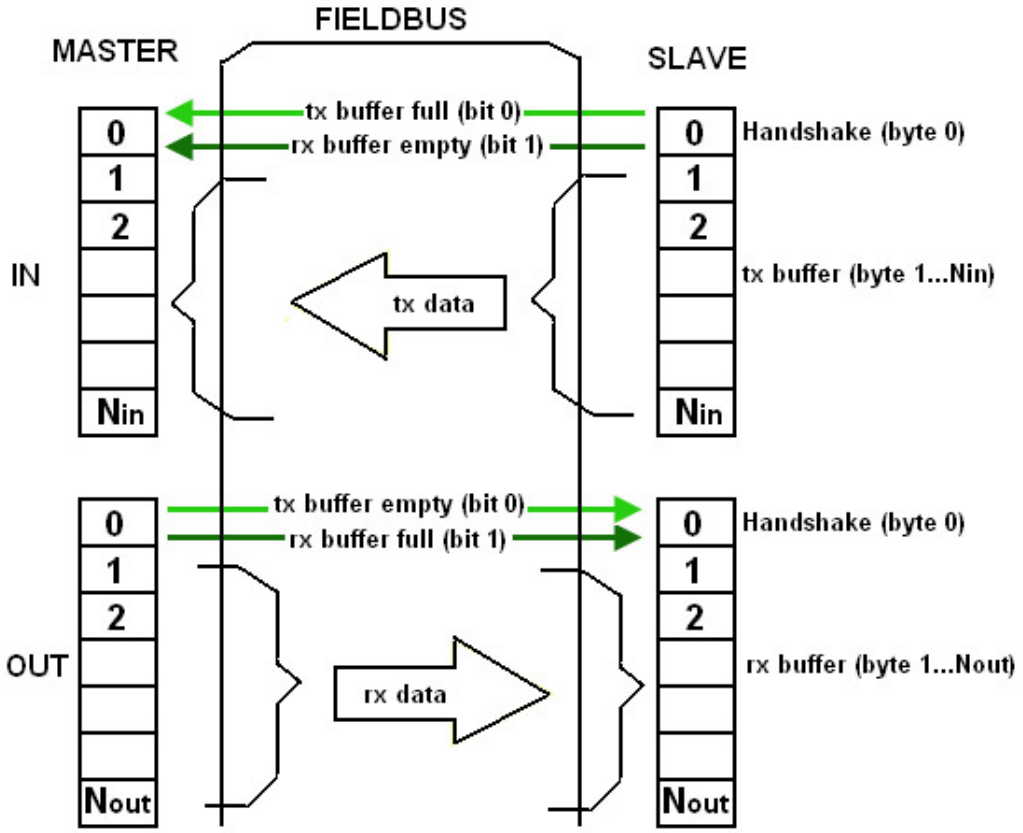


Figure 69 - Message Exchange with Flow Control

Data Transmission Slave → Master

The transmission state machine is shown to understand how a single block is transmitted and received. This protocol guarantees a basic flow control mechanism from slave to master.

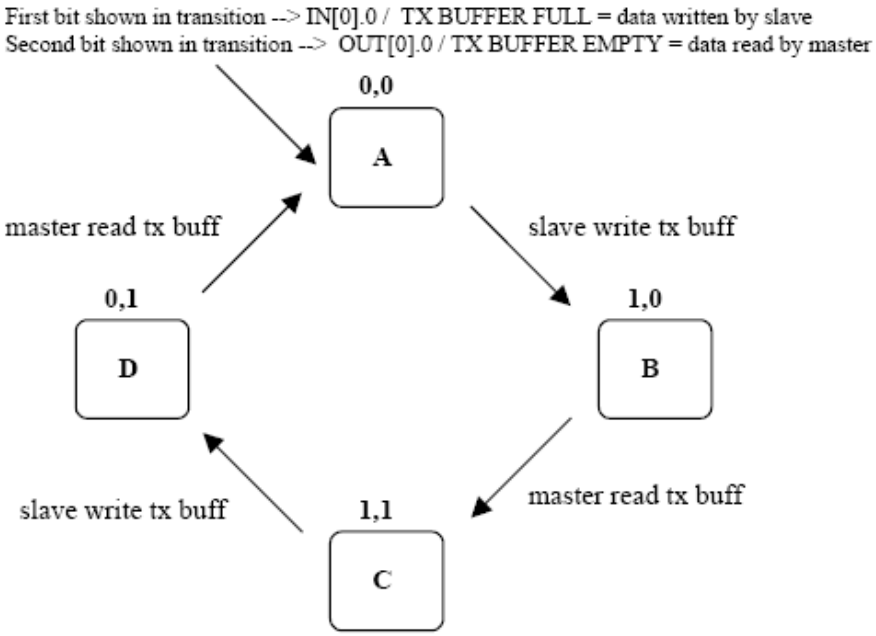

First bit shown in transition --> IN[0].0 / TX BUFFER FULL = data written by slave
Second bit shown in transition --> OUT[0].0 / TX BUFFER EMPTY = data read by master
0,0
A
master read tx buff
slave write tx buff
0,1
D
1,0
B
slave write tx buff
1,1
C
master read tx buff

Figure 70 - Slave to Master Transmission State Machine

Data Transmission Master → Slave

The receive state machine is shown to understand how a single block is transmitted by the master and received by a slave. This protocol guarantees a basic flow control mechanism from master to slave.

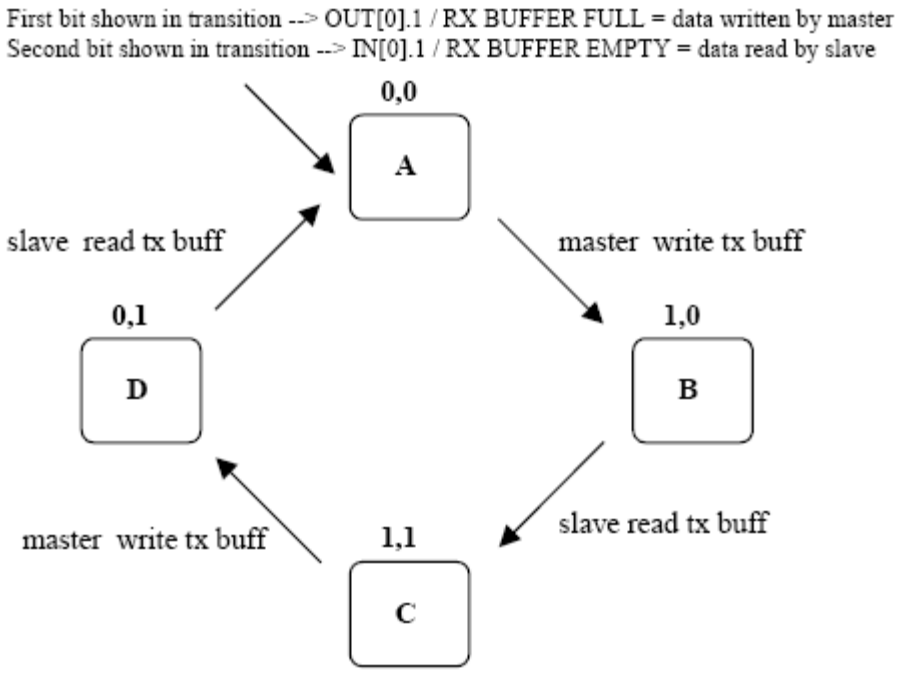

First bit shown in transition --> OUT[0].1 / RX BUFFER FULL = data written by master
Second bit shown in transition --> IN[0].1 / RX BUFFER EMPTY = data read by slave
0,0
A
slave read tx buff
master write tx buff
0,1
D
1,0
B
master write tx buff
1,1
C
slave read tx buff

Figure 71 - Master to Slave Reception State Machine

Resynchronization Protocol

Resynchronization may be used at the master startup, both to detect if a slave is on line or not, or to restart the messaging protocol from a predefined state. It is also used during normal operations in case of errors requiring a protocol reset procedure to be started.

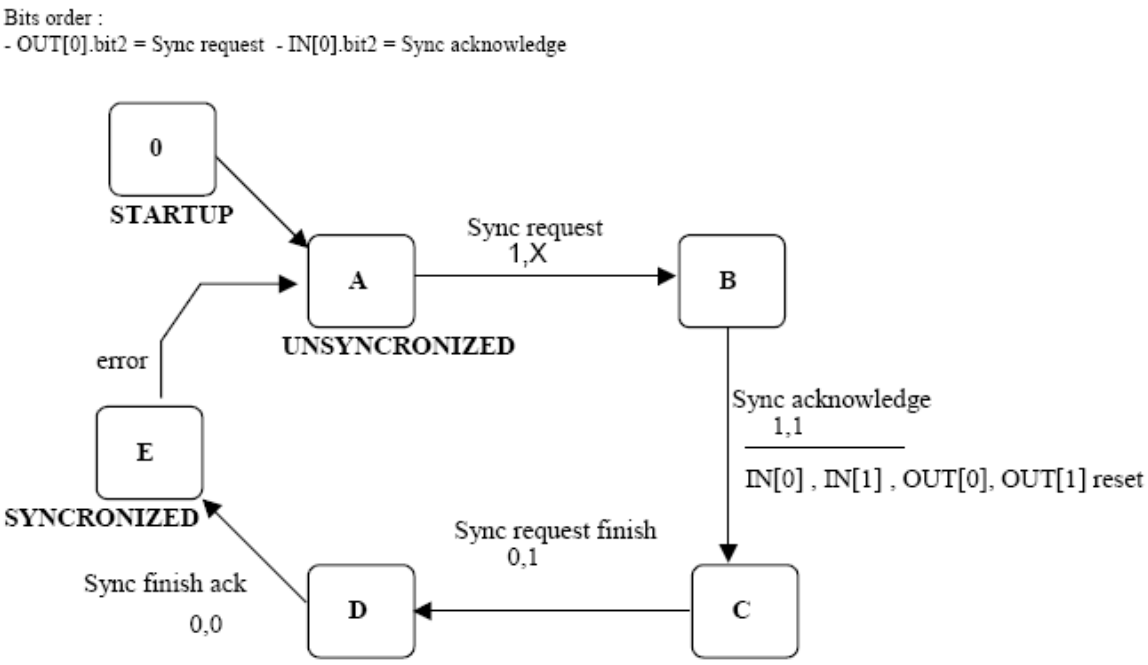


Figure 72 - Resynchronization State Machine

9.4.3 SAP Field

SAP (Service Access Point) is an identifier that is used to share the same communication channel between processes of two remote stations. This allows splitting the single service into different services.

SAP = 0 is actually used by the slave to transfer acquisition information; it should also be used to transfer application data from Master to Slave.

SAP = 2 is currently reserved.

SAP = 255 is currently reserved.

Only SAP 255 and 2 are reserved. All other SAPs are free and may be used by new application programs.

9.4.4 Length Field

The Application layer uses all or a part of the remaining bytes of the Exchange Area buffers that are not used by the Balluff AnyBus Protocol. The Length Field is introduced to keep the information of how many bytes are really used by the Application Layer. A fragment that is not the last one of a fragmentation sequence must fill this field with Max(In/Out)Bytes-3, depending on whether it is an INPUT/OUTPUT fragment. Otherwise this field is filled with a number that is less than or equal to Max(In/Out)Bytes-3.

9.4.5 Application Data Buffer

The Application data buffer holds the CBx commands described in the CBx Command Protocol Reference Manual.

9.5 EXAMPLES OF PROFIBUS COMMAND/RESPONSE MECHANISM

As seen in par. 1.3, there are two buffers – an OUTPUT Buffer that is controlled by the MASTER, and an INPUT Buffer that is controlled by the slave (the Processor unit).

The **OUTPUT Buffer** is mapped the following way:

Output Buffer	
Byte #	
00:	OUTPUT BUFFER CONTROL BYTE (OBCB)
01:	(Always 0)
02:	Packet Length in Bytes
03:	Packet Bytes (Command)
04:	" "
05:	" "
06:	" "
07:	" "
08:	" "
09:	" "
10:	" "
-	" "
-	" "
N-2:	" "
N-1:	Data Consistency Byte (OBDCB)

Byte 0 is the **Output Buffer Control Byte**. The Master uses the lowest two bits of this byte for handshaking: to signal that a command is ready for the slave (**Bit 1**), and to acknowledge receiving a response from the slave (**Bit 0**).

OUTPUT BUFFER CONTROL BYTE							
7	6	5	4	3	2	1	0
[1]	[0]	[0]	[0]	[0]	**[0]**	**[0]**	**[0]**

Bit 0 is toggled by the Master to acknowledge a packet (response) from the Processor unit.

Bit 1 is toggled by the Master when it has a packet (command) ready for the Processor unit.

Bit 2 is set when the Master wishes to initiate a "Resynchronization" with the Slave, and then cleared when it sees the corresponding handshake from the Slave, (indicating that the resynchronization is complete).

Bit 3 is set by the Slave when the total CBx response being returned to the Master is larger than the space available in the Input Buffer (or that the packet being returned is a fragment, and that there are more fragments to follow). This bit is cleared for the final fragment of a fragmented response – and so the Master can know when all the fragments of a response have been returned from the Slave.

Bit 7 is always 1, to conform to Balluff's proprietary Protocol.

Byte 1: is always 0.

Byte 2: contains the length of the packet in bytes (CBx Command or Command Fragment) to be sent to the Processor unit. This can be the length of an entire CBx command, or the length of a fragment of a command, if the CBx command is larger than the space allowed to send it in a single fragment.

Byte 3 through Byte N-2 are used for the actual CBx Command or Command Fragment to be sent.

Byte N-1: the final byte of the Output Buffer is the **Data Consistency Byte.** It is a copy of the **Ouptut Buffer Control Byte.** When changes to the Control Byte are made, the same changes must also be made in the Data Consistency Byte, before the changes "take effect". This is to guarantee the validity of the data between the two bytes.

The **INPUT Buffer** is controlled by the Slave (BIS M-622 RFID Processor unit) and is mapped the same way, except for the packet bytes containing a response (or response fragment) from the processor unit.

Input Buffer	
Byte #	
00:	INPUT BUFFER CONTROL BYTE (IBCB)
01:	(Always 0)
02:	Packet Length in Bytes
03:	Packet Bytes (Response)
04:	" "
05:	" "
06:	" "
07:	" "
08:	" "
09:	" "
10:	" "
-	" "
-	" "
N-2:	" "
N-1:	Data Consistency Byte (IBDCB)

Byte 0 is the **Input Buffer Control Byte.** The Slave uses the lowest four bits of this byte for handshaking: to acknowledge receiving a command from the master (Bit 1), and to signal that a response is ready for the master (Bit 0).

INPUT BUFFER CONTROL BYTE							
7	6	5	4	3	2	1	0
[1]	[0]	[0]	[0]	**[0]**	**[0]**	**[0]**	**[0]**

Bit 0 is toggled by the Slave when it has a new packet (response or response fragment) ready for the Master.

Bit 1 is toggled by the Slave to acknowledge a packet (command or command fragment) from the Master.

Bit 2 is set by the Slave after it completes resynchronization, and then cleared once the Master has acknowledged that resynchronization is complete.

Bit 3 is set by the Slave when the total CBx response being returned to the Master is larger than the space available in the Input Buffer (or that the packet being returned is a fragment, and that there are more fragments to follow). This bit is cleared for the final fragment of a fragmented response – and so the Master can know when all the fragments of a response have been returned from the Slave.

Bit 7 is set to 1 as soon as the Slave has been successfully initialized at power-up, and remains at 1, to conform to Balluff's proprietary Protocol.

Byte 1: is always 0.

Byte 2: contains the length of the packet in bytes (CBx response or response fragment) to be sent back to the Master.

Byte 3 through Byte N-2 are used for the actual CBx response or response fragment to be sent.

Byte N-1: The final byte of the Input Buffer is the Data Consistency Byte for the Input Buffer. It is a copy of the Input Buffer Control Byte. The Master should check that these two bytes are the same, before considering the Input Buffer's data to be valid.

NOTE

The input and output buffers can exceed 64 bytes. The combined total of the input and output buffers cannot exceed 152 bytes.

9.5.1 Example 1: Normal Command/Response Sequence

For this example, the Master will send a CBx "Read Tag ID" command to the Slave (the Processor unit) to read an 8-byte tag ID from an RFID Tag. First we will see a "Tag Not Found" error (assuming that the tag is not read) and then we will see a successful read of the Tag ID.

We will assume for this example that both the Input and Output Buffers have been configured to 32 bytes each. This means that the processor unit response (for this command) can fit entirely in the input buffer, and no fragmentation is required.

Sending the command:

In **Byte 2** of the output buffer the Master places the length (in bytes) of the data packet (CBx Command) we are sending. In this case the CBx command we are sending is 12 bytes. This length is the length of the command bytes we are interested in sending, not the full size of the buffer. The length also does not include the "Data Consistency Byte" at the end of the buffer. That is just a mirror of the Control Byte.

In Byte 3 through **Byte 14** the Master places the 12 bytes of this particular CBx command. Some CBx commands are larger, but all will be at least 12 bytes, even if some of those 12 bytes are not actually used.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	80	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	**0C**	**(Packet length in bytes)**	02:	00	
03: 04: 05: 06: 07: 08: 09: 10: 11: 12: 13: 14: 15: 16: 17: 18: 19: 20: .. 30:	**00** **06** **AA** **07** **00** **01** **03** **E8** **00** **00** **00** **00** 00 00 00 00 00 00 .. 00	**(CBx Command word length MSB)** **(CBx Command word length LSB)** Minimum of 6 words **(CBx Command Type)** Always AA **(CBx Command Opcode)** 0x07 = Read Tag ID **(CBx Command, byte not used)** **(CBx Command "Node ID")** **(CBx Command Timeout MSB)** **(CBx Command Timeout LSB)** 0xE8 = 1000 ms timeout **(CBx Command Not Used)** **(CBx Command Not Used)** **(CBx Command Not Used)** **(CBx Command Not Used)**	03: 04: 05: 06: 07: 08: 09: 10: 11: 12: 13: 14: 15: 16: 17: 18: 19: 20: .. 30:	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .. 00	
31:	80	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

Now that the command is in the Output Buffer, The Master alerts the Slave that the command is ready. It does this by toggling **Bit 1** of the **Output Buffer Control Byte** (the **OBCB**) and then also toggling the same bit in the **Output Buffer Data Consistence Byte** (the **OBDCB**).

NOTE

This bit is a toggle. So if it is 0, it is toggled to 1 to indicate a new command. If it is 1, it is toggled to 0 to indicate a new command. If the bit is 1, setting it to 0, and then back to 1 will cause the command to be issued twice.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	**82**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1]** [0]	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	0C	(Packet length in bytes)	02:	00	
03:	00	(CBx Command word length MSB)	03:	00	
04:	06	(CBx Command word length LSB)	04:	00	
05:	AA	(CBx Command Type)	05:	00	
06:	07	(CBx Command Opcode)	06:	00	
07:	00	(CBx Command, byte not used)	07:	00	
08:	01	(CBx Command “Node ID”)	08:	00	
09:	03	(CBx Command Timeout MSB)	09:	00	
10:	E8	(CBx Command Timeout LSB)	10:	00	
11:	00	(CBx Command Not Used)	11:	00	
12:	00	(CBx Command Not Used)	12:	00	
13:	00	(CBx Command Not Used)	13:	00	
14:	00	(CBx Command Not Used)	14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..	..		..	..	
30:	00		30:	00	
31:	**82**	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

When the Slave sees Bit 1 of the **OBCB & OBDBC** toggle, it grabs the command from the **Output Buffer.** The Slave then acknowledges the command by toggling **Bit 1** of the **Input Buffer Control Byte** (the **IBCB**) and also the same bit of the **Input Buffer Data Consistency Byte** (the **IBDCB**).

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	82	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]	00	**82**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1]** [0]
01:	00	(Always 0)	01:	00	
02:	0C	(Packet length in bytes)	02:	00	
03:	00	(CBx Command word length MSB)	03:	00	
04:	06	(CBx Command word length LSB)	04:	00	
05:	AA	(CBx Command Type)	05:	00	
06:	07	(CBx Command Opcode)	06:	00	
07:	00	(CBx Command, byte not used)	07:	00	
08:	01	(CBx Command “Node ID”)	08:	00	
09:	03	(CBx Command Timeout MSB)	09:	00	
10:	E8	(CBx Command Timeout LSB)	10:	00	
11:	00	(CBx Command Not Used)	11:	00	
12:	00	(CBx Command Not Used)	12:	00	
13:	00	(CBx Command Not Used)	13:	00	
14:	00	(CBx Command Not Used)	14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..	..		..	..	
30:	00		30:	00	
31:	82	**Data Consistency Byte (OBDCB)**	31:	**82**	**Data Consistency Byte (IBDCB)**

The Slave writes the response into the **Input Buffe**r, and toggles **Bit 0** of the **IBCB** to indicate that there is a response fragment ready for the master. Since the entire response fits in the buffer, it does not need to use fragmentation. The Slave also simultaneously makes the same changes to the **IBDCB**.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	82	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]	00	**83**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1] [1]**
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	**0E**	**(Packet length in bytes)**
03:	00	(CBx Command word length MSB)	03:	**00**	**(CBx Response word length MSB)**
04:	06	(CBx Command word length LSB)	04:	**07**	**(CBx Response word length LSB)**
05:	AA	(CBx Command Type)			Minimum of 6 words
06:	07	(CBx Command Opcode)	05:	**FF**	**(CBx Response Type) FF=Error**
07:	00	(CBx Command, byte not used)	06:	**FF**	**(CBx Response Opcode) FF=Error**
08:	01	(CBx Command “Node ID”)	07:	**00**	**(CBx Response Instance Counter)**
09:	03	(CBx Command Timeout MSB)	08:	**01**	**(CBx Response “Node ID”)**
10:	E8	(CBx Command Timeout LSB)	09:	**01**	**(CBx Response Timestamp Month)**
11:	00	(CBx Command Not Used)	10:	**01**	**(CBx Response Timestamp Day)**
12:	00	(CBx Command Not Used)	11:	**00**	**(CBx Response Timestamp Hour)**
13:	00	(CBx Command Not Used)	12:	**13**	**(CBx Response Timestamp Minute)**
14:	00	(CBx Command Not Used)	13:	**22**	**(CBx Response Timestamp Second)**
15:	00		14:	**01**	**(CBx Response “Data length”)**
16:	00				1 byte (the Error Code)
17:	00		15:	**07**	**(CBx Response Data Byte 1)**
18:	00				Error Code 7 = Tag Not Found
19:	00		16:	**00**	**(CBx Response byte not used)**
20:	00		17:	00	
..	..		18:	00	
30:	00		19:	00	
			20:	00	
			..	..	
			30:	00	
31:	82	**Data Consistency Byte (OBDCB)**	31:	**83**	**Data Consistency Byte (IBDCB)**

In this case, the response is a "Tag Not Found" error.

The Master can see that **Bit 0** of the **IBCB & IBDCB** has been toggled, so it knows that the response in the Input Buffer is ready. Since **Bit 2** of the **IBCB & IBDCB** is **not** set to 1, it knows that the response is complete (not a fragment).

The Master now toggles **Bit 0** of the **OBCB & OBDCB** to acknowledge that it has received the response.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**83**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] **[1]**	00	83	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [1]
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	0E	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	00	(CBx Response word length MSB)
04:	06	(CBx Command word length LSB)	04:	07	(CBx Response word length LSB) Minimum of 6 words
05:	AA	(CBx Command Type)	05:	FF	(CBx Response Type) FF=Error
06:	07	(CBx Command Opcode)	06:	FF	(CBx Response Opcode) FF=Error
07:	00	(CBx Command, byte not used)	07:	00	(CBx Response Instance Counter)
08:	01	(CBx Command “Node ID”)	08:	01	(CBx Response “Node ID”)
09:	03	(CBx Command Timeout MSB)	09:	01	(CBx Response Timestamp Month)
10:	E8	(CBx Command Timeout LSB)	10:	01	(CBx Response Timestamp Day)
11:	00	(CBx Command Not Used)	11:	00	(CBx Response Timestamp Hour)
12:	00	(CBx Command Not Used)	12:	13	(CBx Response Timestamp Minute)
13:	00	(CBx Command Not Used)	13:	22	(CBx Response Timestamp Second)
14:	00	(CBx Command Not Used)	14:	01	(CBx Response “Data length”) 1 byte (the Error Code)
15:	00		15:	07	(CBx Response Data Byte 1) Error Code 7 = Tag Not Found
16:	00		16:	00	(CBx Response byte not used)
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..	..		..	..	
30:	00		30:	00	
31:	**83**	**Data Consistency Byte (OBDCB)**	31:	83	**Data Consistency Byte (IBDCB)**

The command/response sequence has completed. A command has been issued and the response received (in this case, a “Tag Not Found” error) and the response has been acknowledged.

If we now place a tag on the processor unit's antenna, we can reissue the same command by toggling **Bit 1** of the **OBCB & OBDCB** again.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**81**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[0]** [1]	00	83	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [1]
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	0E	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	00	(CBx Response word length MSB)
04:	06	(CBx Command word length LSB)	04:	07	(CBx Response word length LSB) Minimum of 6 words
05:	AA	(CBx Command Type)	05:	FF	(CBx Response Type) FF=Error
06:	07	(CBx Command Opcode)	06:	FF	(CBx Response Opcode) FF=Error
07:	00	(CBx Command, byte not used)	07:	00	(CBx Response Instance Counter)
08:	01	(CBx Command "Node ID")	08:	01	(CBx Response "Node ID")
09:	03	(CBx Command Timeout MSB)	09:	01	(CBx Response Timestamp Month)
10:	E8	(CBx Command Timeout LSB)	10:	01	(CBx Response Timestamp Day)
11:	00	(CBx Command Not Used)	11:	00	(CBx Response Timestamp Hour)
12:	00	(CBx Command Not Used)	12:	13	(CBx Response Timestamp Minute)
13:	00	(CBx Command Not Used)	13:	22	(CBx Response Timestamp Second)
14:	00	(CBx Command Not Used)	14:	01	(CBx Response "Data length") 1 byte (the Error Code)
15:	00		15:	07	(CBx Response Data Byte 1) Error Code 7 = Tag Not Found
16:	00		16:	00	(CBx Response byte not used)
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..	..		..	..	
30:	00		30:	00	
31:	**81**	**Data Consistency Byte (OBDCB)**	31:	83	**Data Consistency Byte (IBDCB)**

The processor unit will toggle **Bit 1** of the **IBCB & IBDCB** to indicate it has received the command.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	81	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [1]	00	**81**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[0]** [1]
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	0E	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	00	(CBx Response word length MSB)
04:	06	(CBx Command word length LSB)	04:	07	(CBx Response word length LSB) Minimum of 6 words
05:	AA	(CBx Command Type)	05:	FF	(CBx Response Type) FF=Error
06:	07	(CBx Command Opcode)	06:	FF	(CBx Response Opcode) FF=Error
07:	00	(CBx Command, byte not used)	07:	00	(CBx Response Instance Counter)
08:	01	(CBx Command “Node ID”)	08:	01	(CBx Response “Node ID”)
09:	03	(CBx Command Timeout MSB)	09:	01	(CBx Response Timestamp Month)
10:	E8	(CBx Command Timeout LSB)	10:	01	(CBx Response Timestamp Day)
11:	00	(CBx Command Not Used)	11:	00	(CBx Response Timestamp Hour)
12:	00	(CBx Command Not Used)	12:	13	(CBx Response Timestamp Minute)
13:	00	(CBx Command Not Used)	13:	22	(CBx Response Timestamp Second)
14:	00	(CBx Command Not Used)	14:	01	(CBx Response “Data length”) 1 byte (the Error Code)
15:	00		15:	07	(CBx Response Data Byte 1) Error Code 7 = (Tag Not Found)
16:	00		16:	00	(CBx Response byte not used)
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..	..		..	..	
30:	00		30:	00	
31:	81	**Data Consistency Byte (OBDCB)**	31:	**81**	**Data Consistency Byte (IBDCB)**

We will assume that the Slave successfully reads the RFID tag.

The Slave writes the response into the Input Buffer, and toggles **Bit 0** of the **IBCB & IBDCB** to indicate that the response is ready.

NOTE

If the master has not acknowledged receiving the previous response, the processor unit will not be able to place the response in the Input Buffer.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	81	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [1]	00	**80**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] **[0]**
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	**14**	**(Packet length in bytes)**
03:	00	(CBx Command word length MSB)	03:	**00**	**(CBx Response word length MSB)**
04:	06	(CBx Command word length LSB)	04:	**0A**	**(CBx Response word length LSB)** Minimum of 6 words
05:	AA	(CBx Command Type)	05:	**AA**	**(CBx Response Type)** AA=Normal Response
06:	07	(CBx Command Opcode)	06:	**07**	**(CBx Response Opcode)** 07=Command Echo of Tag Read ID
07:	00	(CBx Command, byte not used)	07:	**01**	**(CBx Response Instance Counter)**
08:	01	(CBx Command “Node ID”)	08:	**01**	**(CBx Response “Node ID”)**
09:	03	(CBx Command Timeout MSB)	09:	**01**	**(CBx Response Timestamp Month)**
10:	E8	(CBx Command Timeout LSB)	10:	**01**	**(CBx Response Timestamp Day)**
11:	00	(CBx Command Not Used)	11:	**01**	**(CBx Response Timestamp Hour)**
12:	00	(CBx Command Not Used)	12:	**17**	**(CBx Response Timestamp Minute)**
13:	00	(CBx Command Not Used)	13:	**58**	**(CBx Response Timestamp Second)**
14:	00	(CBx Command Not Used)	14:	**08**	**(CBx Response “Data length”)** 8 bytes (the Tag ID)
15:	00		15:	**E0**	**(CBx Response Data Byte 1)** Tag ID Byte 1
16:	00		16:	**04**	**(CBx Response Data Byte 2)** Tag ID Byte 2
17:	00		17:	**01**	**(CBx Response Data Byte 3)** Tag ID Byte 3
18:	00		18:	**00**	**(CBx Response Data Byte 4)** Tag ID Byte 4
19:	00		19:	**0E**	**(CBx Response Data Byte 5)** Tag ID Byte 5
20:	00		20:	**20**	**(CBx Response Data Byte 6)** Tag ID Byte 6
..	..		21:	**DD**	**(CBx Response Data Byte 7)** Tag ID Byte 7
30:	00		22:	**AF**	**(CBx Response Data Byte 8)** Tag ID Byte 8
			..	..	
			30:	00	
31:	81	**Data Consistency Byte (OBDCB)**	31:	**80**	**Data Consistency Byte (IBDCB)**

You can see the Tag ID in the data portion of the CBx response, Tag ID **E00401000E20DDAF**.

The Master can see that **Bit 0** of the **IBCB & IBDCB** has been toggled, so it knows that the response in the Input Buffer is ready. Since **Bit 2** is not set to 1, it knows that the response is complete (not a fragment).

The Master now toggles **Bit 0** of the **OBCB** & **OBDCB** to acknowledge that it has received the response.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	80	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] **[0]**	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	14	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	00	(CBx Response word length MSB)
04:	06	(CBx Command word length LSB)	04:	0A	(CBx Response word length LSB) Minimum of 6 words
05:	AA	(CBx Command Type)	05:	AA	(CBx Response Type) AA=Normal Response
06:	07	(CBx Command Opcode)	06:	07	(CBx Response Opcode) 07=Command Echo of Tag Read ID
07:	00	(CBx Command, byte not used)	07:	01	(CBx Response Instance Counter)
08:	01	(CBx Command “Node ID”)	08:	01	(CBx Response “Node ID”)
09:	03	(CBx Command Timeout MSB)	09:	01	(CBx Response Timestamp Month)
10:	E8	(CBx Command Timeout LSB)	10:	01	(CBx Response Timestamp Day)
11:	00	(CBx Command Not Used)	11:	01	(CBx Response Timestamp Hour)
12:	00	(CBx Command Not Used)	12:	17	(CBx Response Timestamp Minute)
13:	00	(CBx Command Not Used)	13:	58	(CBx Response Timestamp Second)
14:	00	(CBx Command Not Used)	14:	08	(CBx Response “Data length”) 8 bytes (the Tag ID)
15:	00		15:	E0	(CBx Response Data Byte 1) Tag ID Byte 1
16:	00		16:	04	(CBx Response Data Byte 2) Tag ID Byte 2
17:	00		17:	01	(CBx Response Data Byte 3) Tag ID Byte 3
18:	00		18:	00	(CBx Response Data Byte 4) Tag ID Byte 4
19:	00		19:	0E	(CBx Response Data Byte 5) Tag ID Byte 5
20:	00		20:	20	(CBx Response Data Byte 6) Tag ID Byte 6
..	..		21:	DD	(CBx Response Data Byte 7) Tag ID Byte 7
30:	00		22:	AF	(CBx Response Data Byte 8) Tag ID Byte 8
			..	..	
			30:	00	
31:	80	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

The command/response sequence has completed. A command has been issued and the response received (in this case, a successful read of the RFID Tag ID) and the response has been acknowledged.

9.5.2 Example 2: Unsolicited Responses (Continuous Read Mode)

In some modes (such as Continuous Read Mode) the slave can generate unsolicited responses. If the Slave generates an unsolicited response, it will place the response in the Input Buffer, as long as the Master has acknowledged receiving the previous response. If the Master does not perform the handshake to acknowledge the previous response, the responses will accumulate in the internal memory buffer of the Slave (The RFID processor unit has an internal **2K buffer** for responses) and the responses will remain until the handshakes are performed for each response.

For this example, the processor unit automatically reads a tag (6 bytes of data), and places the “response” in the Input Buffer, and toggles **Bit 0** to indicate that a response is waiting.

Although no command was issued by the Master, we will still call this a “response”.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
		Output Buffer Control Byte (OBCB)			**Input Buffer Control Byte (IBCB)**
00:	80	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]	00	**81**	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] **[1]**
01:	00	(Always 0)	01:	00	(Always 0)
02:	00	(Packet length in bytes)	02:	**12**	**(Packet length in bytes)**
03:	00		03:	**00**	**(CBx Response word length MSB)**
04:	00		04:	**09**	**(CBx Response word length LSB)** Minimum of 6 words
05:	00				
06:	00		05:	**AA**	**(CBx Response Type)** AA=Normal Response
07:	00				
08:	00		06:	**0D**	**(CBx Response Opcode)** 0D=Continuous Read Response
09:	00				
10:	00		07:	**01**	**(CBx Response Instance Counter)**
11:	00		08:	**01**	**(CBx Response “Node ID”)**
12:	00		09:	**01**	**(CBx Response Timestamp Month)**
13:	00		10:	**01**	**(CBx Response Timestamp Day)**
14:	00		11:	**02**	**(CBx Response Timestamp Hour)**
15:	00		12:	**12**	**(CBx Response Timestamp Minute)**
16:	00		13:	**34**	**(CBx Response Timestamp Second)**
17:	00		14:	**06**	**(CBx Response “Data length”)** 6 bytes (the Tag ID)
18:	00				
19:	00		15:	**11**	**(CBx Response Data Byte 1)** Tag ID Byte 1
20:	00				
..	..		16:	**22**	**(CBx Response Data Byte 2)** Tag ID Byte 2
30:	00				
			17:	**33**	**(CBx Response Data Byte 3)** Tag ID Byte 3
			18:	**44**	**(CBx Response Data Byte 4)** Tag ID Byte 4
			19:	**55**	**(CBx Response Data Byte 5)** Tag ID Byte 5
			20:	**66**	**(CBx Response Data Byte 6)** Tag ID Byte 6
			..	..	
			30:	00	
31:	80	**Data Consistency Byte (OBDCB)**	31:	**81**	**Data Consistency Byte (IBDCB)**

The Master can see that **Bit 0** of the **IBCB & IBDCB** has been toggled, so it knows that a new response in the Input Buffer is ready (even though it hasn't issued a command).

Since **Bit 2** is not set to 1, it knows that the response is complete (not a fragment).

The Master now toggles **Bit 0** of the **OBCB** & **OBDCB** to acknowledge that it has received the response.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**81**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] **[1]**	00	81	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [1]
01:	00	(Always 0)	01:	00	(Always 0)
02:	00	(Packet length in bytes)	02:	12	(Packet length in bytes)
03:	00		03:	00	(CBx Response word length MSB)
04:	00		04:	09	(CBx Response word length LSB) Minimum of 6 words
05:	00		05:	AA	(CBx Response Type) AA=Normal Response
06:	00		06:	0D	(CBx Response Opcode) 0D=Continuous Read Response
07:	00		07:	01	(CBx Response Instance Counter)
08:	00		08:	01	(CBx Response "Node ID")
09:	00		09:	01	(CBx Response Timestamp Month)
10:	00		10:	01	(CBx Response Timestamp Day)
11:	00		11:	02	(CBx Response Timestamp Hour)
12:	00		12:	12	(CBx Response Timestamp Minute)
13:	00		13:	34	(CBx Response Timestamp Second)
14:	00		14:	06	(CBx Response "Data length") 6 bytes (the Tag ID)
15:	00		15:	11	(CBx Response Data Byte 1) Tag ID Byte 1
16:	00		16:	22	(CBx Response Data Byte 2) Tag ID Byte 2
17:	00		17:	33	(CBx Response Data Byte 3) Tag ID Byte 3
18:	00		18:	44	(CBx Response Data Byte 4) Tag ID Byte 4
19:	00		19:	55	(CBx Response Data Byte 5) Tag ID Byte 5
20:	00		20:	66	(CBx Response Data Byte 6) Tag ID Byte 6
..	..		..	..	
30:	00		30:	00	
31:	**81**	**Data Consistency Byte (OBDCB)**	31:	81	**Data Consistency Byte (IBDCB)**

The response has been acknowledged (a read of 6 bytes: 11 22 33 44 55 66).

The reader then reads another tag, puts another response in the Input Buffer, and toggles **Bit 0** again in the **IBCB & IBDCB**.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	81	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [1]	00	**80**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] **[0]**
01:	00	(Always 0)	01:	00	(Always 0)
02:	00	(Packet length in bytes)	02:	**12**	**(Packet length in bytes)**
03:	00		03:	**00**	**(CBx Response word length MSB)**
04:	00		04:	**09**	**(CBx Response word length LSB)**
05:	00				Minimum of 6 words
06:	00		05:	**AA**	**(CBx Response Type)**
07:	00				AA=Normal Response
08:	00		06:	**0D**	**(CBx Response Opcode)**
09:	00				0D=Continuous Read Response
10:	00		07:	**02**	**(CBx Response Instance Counter)**
11:	00		08:	**01**	**(CBx Response "Node ID")**
12:	00		09:	**01**	**(CBx Response Timestamp Month)**
13:	00		10:	**01**	**(CBx Response Timestamp Day)**
14:	00		11:	**02**	**(CBx Response Timestamp Hour)**
15:	00		12:	**13**	**(CBx Response Timestamp Minute)**
16:	00		13:	**34**	**(CBx Response Timestamp Second)**
17:	00		14:	**06**	**(CBx Response "Data length")**
18:	00				6 bytes (the Tag ID)
19:	00		15:	**77**	**(CBx Response Data Byte 1)**
20:	00				Tag ID Byte 1
..	..		16:	**88**	**(CBx Response Data Byte 2)**
30:	00				Tag ID Byte 2
			17:	**99**	**(CBx Response Data Byte 3)**
					Tag ID Byte 3
			18:	**AA**	**(CBx Response Data Byte 4)**
					Tag ID Byte 4
			19:	**BB**	**(CBx Response Data Byte 5)**
					Tag ID Byte 5
			20:	**CC**	**(CBx Response Data Byte 6)**
					Tag ID Byte 6
			..	..	
			30:	00	
31:	81	**Data Consistency Byte (OBDCB)**	31:	**80**	**Data Consistency Byte (IBDCB)**

This response contains a timestamp that is 60 seconds after the previous response, and tag has different data.

Note that the "Instance Counter" in the CBx response increments for each response.

The Master can see that **Bit 0** of the **IBCB & IBDCB** has been toggled, so it knows that a new response in the Input Buffer is ready.

The Master now toggles **Bit 0** of the **OBCB** & **OBDCB** to acknowledge that it has received the response.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**80**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] **[0]**	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	(Always 0)
02:	00	(Packet length in bytes)	02:	12	(Packet length in bytes)
03:	00		03:	00	(CBx Response word length MSB)
04:	00		04:	09	(CBx Response word length LSB) Minimum of 6 words
05:	00		05:	AA	(CBx Response Type) AA=Normal Response
06:	00		06:	0D	(CBx Response Opcode) 0D=Continuous Read Response
07:	00		07:	02	(CBx Response Instance Counter)
08:	00		08:	01	(CBx Response “Node ID”)
09:	00		09:	01	(CBx Response Timestamp Month)
10:	00		10:	01	(CBx Response Timestamp Day)
11:	00		11:	02	(CBx Response Timestamp Hour)
12:	00		12:	13	(CBx Response Timestamp Minute)
13:	00		13:	34	(CBx Response Timestamp Second)
14:	00		14:	06	(CBx Response “Data length”) 6 bytes (the Tag ID)
15:	00		15:	77	(CBx Response Data Byte 1) Tag ID Byte 1
16:	00		16:	88	(CBx Response Data Byte 2) Tag ID Byte 2
17:	00		17:	99	(CBx Response Data Byte 3) Tag ID Byte 3
18:	00		18:	AA	(CBx Response Data Byte 4) Tag ID Byte 4
19:	00		19:	BB	(CBx Response Data Byte 5) Tag ID Byte 5
20:	00		20:	CC	(CBx Response Data Byte 6) Tag ID Byte 6
..	..		..	..	
30:	00		30:	00	
31:	**80**	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

No new responses will come from the reader until the Master has acknowledged the previous response by toggling **Bit 0** of the **OBCB & OBDCB**.

9.5.3 Example 3: Fragmentation of Responses

For this example, the Master will send a CBx “Read Tag Data” command to the Slave (the Processor unit) to read 50 bytes from a tag.

We will assume for this example that the both the input and output buffers have been configured to 32 bytes each. This means that the processor unit response to the tag read command cannot completely fit in the input buffer, and the response will be “**fragmented**” or sent in multiple fragments.

Sending the command:

In **Byte 2** of the output buffer, the Master places the length (in bytes) of the data packet (CBx Command) we are sending. In this case the CBx command we are sending is 12 bytes. This length is the length of the command bytes we are interested in sending, not the full size of the buffer. The length also does not include the “Data Consistency Byte” at the end of the buffer. That is just a mirror of the Control Byte.

In Byte 3 through **Byte 14** the Master places the 12 bytes of this particular CBx command. Some CBx commands are larger, but all will be at least 12 bytes, even if some of those 12 bytes are not actually used.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	80	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	**0C**	**(Packet length in bytes)**	02:	00	
03:	**00**	**(CBx Command word length MSB)**	03:	00	
04:	**06**	**(CBx Command word length LSB)** Minimum of 6 words	04: 05:	00 00	
05:	**AA**	**(CBx Command Type)** Always AA	06:	00	
06:	**05**	**(CBx Command Opcode)** 0x05 = Read Tag Data	07: 08:	00 00	
07:	**00**	**(CBx Command, byte not used)**	09:	00	
08:	**01**	**(CBx Command “Node ID”)**	10:	00	
09:	**03**	**(CBx Command Timeout MSB)**	11:	00	
10:	**E8**	**(CBx Command Timeout LSB)** 0xE8 = 1000 ms timeout	12: 13:	00 00	
11:	**00**	**(CBx Command Start Address MSB)**	14:	00	
12:	**00**	**(CBx Command Start Address LSB)** address 0	15: 16:	00 00	
13:	**00**	**(CBx Command Length MSB)**	17:	00	
14:	**32**	**(CBx Command Length LSB)** 50 bytes	18: 19:	00 00	
15:	00		20:	00	
16:	00		..	..	
17:	00		30:	00	
18:	00				
19:	00				
20:	00				
..	..				
30:	00				
31:	80	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

Now that the command is in the Output Buffer, The Master alerts the Slave that the command is ready. It does this by toggling **Bit 1** of the **Output Buffer Control Byte** (the **OBCB**) and then also toggling the same bit in the **Output Buffer Data Consistence Byte** (the **OBDCB**)

NOTE

This bit is a toggle. So if it is 0, it is toggled to 1 to indicate a new command. If it is 1, it is toggled to 0 to indicate a new command. If the bit is 1, setting it to 0, and then back to 1 will cause the command to be issued twice.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**82**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1]** [0]	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	0C	(Packet length in bytes)	02:	00	
03:	00	(CBx Command word length MSB)	03:	00	
04:	06	(CBx Command word length LSB) Minimum of 6 words	04:	00	
			05:	00	
05:	AA	(CBx Command Type) Always AA	06:	00	
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	07:	00	
			08:	00	
07:	00	(CBx Command, byte not used)	09:	00	
08:	01	(CBx Command “Node ID”)	10:	00	
09:	03	(CBx Command Timeout MSB)	11:	00	
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	12:	00	
			13:	00	
11:	00	(CBx Command Start Address MSB)	14:	00	
12:	00	(CBx Command Start Address LSB) address 0	15:	00	
			16:	00	
13:	00	(CBx Command Length MSB)	17:	00	
14:	32	(CBx Command Length LSB) 50 bytes	18:	00	
			19:	00	
15:	00		20:	00	
16:	00		..	..	
17:	00		30:	00	
18:	00				
19:	00				
20:	00				
..	..				
30:	00				
31:	**82**	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

When the Slave sees Bit 1 of the **OBCB & OBDBC** toggle, it grabs the command from the **Output Buffer.** The Slave then acknowledges the command by toggling **Bit 1** of the **Input Buffer Control Byte** (the **IBCB**) and also the same bit of the **Input Buffer Data Consistency Byte** (the **IBDCB**).

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	82	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]	00	**82**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1]** [0]
01:	00	(Always 0)	01:	00	
02:	0C	(Packet length in bytes)	02:	00	
03:	00	(CBx Command word length MSB)	03:	00	
04:	06	(CBx Command word length LSB) Minimum of 6 words	04: 05:	00 00	
05:	AA	(CBx Command Type) Always AA	06:	00	
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	07: 08:	00 00	
07:	00	(CBx Command, byte not used)	09:	00	
08:	01	(CBx Command “Node ID”)	10:	00	
09:	03	(CBx Command Timeout MSB)	11:	00	
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	12: 13:	00 00	
11:	00	(CBx Command Start Address MSB)	14:	00	
12:	00	(CBx Command Start Address LSB) address 0	15: 16:	00 00	
13:	00	(CBx Command Length MSB)	17:	00	
14:	32	(CBx Command Length LSB) 50 bytes	18: 19:	00 00	
15:	00		20:	00	
16:	00		..	..	
17:	00		30:	00	
18:	00				
19:	00				
20:	00				
..	..				
30:	00				
31:	82	**Data Consistency Byte (OBDCB)**	31:	**82**	**Data Consistency Byte (IBDCB)**

The Slave writes the first fragment of the response into the **Input Buffe**r, and toggles **Bit 0** of the **IBCB** to indicate that there is a response fragment ready for the master, and sets **Bit 3** of the **IBCB to 1** to indicate that this is a fragment of a longer response (i.e. there is more data remaining) The Slave also simultaneously makes the same changes to the **IBDCB**.

NOTE

Bit 3 is not a toggle – If it is 1, then there are more fragments to follow. If it is 0, it is either a complete response, or the final fragment of a response.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
		Output Buffer Control Byte (OBCB)			**Input Buffer Control Byte (IBCB)**
00:	82	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]	00	**8B**	7 6 5 4 3 2 1 0 [1] [0] [0] [0] **[1]** [0] [1] **[1]**
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	**1C**	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	**00**	**(CBx Response word length MSB)**
04:	06	(CBx Command word length LSB) Minimum of 6 words	04:	**1F**	**(CBx Response word length LSB)** Minimum of 6 words
05:	AA	(CBx Command Type) Always AA	05:	**AA**	**(CBx Response Type)**
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	06:	**05**	AA=Normal Response **(CBx Response Opcode)**
07:	00	(CBx Command, byte not used)			05=Continuous Read Response
08:	01	(CBx Command “Node ID”)	07:	**00**	**(CBx Response Instance Counter)**
09:	03	(CBx Command Timeout MSB)	08:	**01**	**(CBx Response “Node ID”)**
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	09:	**01**	**(CBx Response Timestamp Month)**
11:	00	(CBx Command Start Address MSB)	10:	**01**	**(CBx Response Timestamp Day)**
12:	00	(CBx Command Start Address LSB) address 0	11:	**00**	**(CBx Response Timestamp Hour)**
13:	00	(CBx Command Length MSB)	12:	**01**	**(CBx Response Timestamp Minute)**
14:	32	(CBx Command Length LSB) 50 bytes	13:	**1D**	**(CBx Response Timestamp Second)**
15:	00		14:	**32**	**(CBx Response “Data length”)** 50 bytes (total Tag Data)
16:	00		15:	**2F**	**(CBx Response Data Byte 1)**
17:	00		16:	**13**	**(CBx Response Data Byte 2)**
18:	00		17:	**19**	**(CBx Response Data Byte 3)**
19:	00		18:	**45**	**(CBx Response Data Byte 4)**
20:	00		19:	**94**	**(CBx Response Data Byte 5)**
..	..		20:	**D1**	**(CBx Response Data Byte 6)**
30:	00		21:	**B5**	**(CBx Response Data Byte 7)**
			22:	**FA**	**(CBx Response Data Byte 8)**
			23:	**C7**	**(CBx Response Data Byte 9)**
			24:	**42**	**(CBx Response Data Byte 10)**
			25:	**33**	**(CBx Response Data Byte 11)**
			26:	**58**	**(CBx Response Data Byte 12)**
			27:	**A3**	**(CBx Response Data Byte 13)**
			28:	**55**	**(CBx Response Data Byte 14)**
			29:	**88**	**(CBx Response Data Byte 15)**
			30:	**49**	**(CBx Response Data Byte 16)**
31:	82	**Data Consistency Byte (OBDCB)**	31:	**8B**	**Data Consistency Byte (IBDCB)**

The Master can see that **Bit 3** of the **IBCB** & **IBDCB** has been set to 1, so it knows that the response in the **Input Buffer** is just a fragment of a longer response, and not a complete response, and that there are more fragments to follow.

The Master now toggles **Bit 0** of the **OBCB** & **OBDCB** to acknowledge that it has received the response fragment.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	83	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [1]	00	8B	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] [1] [1]
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	1C	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	00	(CBx Response word length MSB)
04:	06	(CBx Command word length LSB) Minimum of 6 words	04:	1F	(CBx Response word length LSB) Minimum of 6 words
05:	AA	(CBx Command Type) Always AA	05:	AA	(CBx Response Type) AA=Normal Response
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	06:	05	(CBx Response Opcode) 05=Continuous Read Response
07:	00	(CBx Command, byte not used)	07:	00	(CBx Response Instance Counter)
08:	01	(CBx Command “Node ID”)	08:	01	(CBx Response “Node ID”)
09:	03	(CBx Command Timeout MSB)	09:	01	(CBx Response Timestamp Month)
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	10:	01	(CBx Response Timestamp Day)
11:	00	(CBx Command Start Address MSB)	11:	00	(CBx Response Timestamp Hour)
12:	00	(CBx Command Start Address LSB) address 0	12:	01	(CBx Response Timestamp Minute)
13:	00	(CBx Command Length MSB)	13:	1D	(CBx Response Timestamp Second)
14:	32	(CBx Command Length LSB) 50 bytes	14:	32	(CBx Response “Data length”) 50 bytes (total Tag Data)
15:	00		15:	2F	(CBx Response Data Byte 1)
16:	00		16:	13	(CBx Response Data Byte 2)
17:	00		17:	19	(CBx Response Data Byte 3)
18:	00		18:	45	(CBx Response Data Byte 4)
19:	00		19:	94	(CBx Response Data Byte 5)
20:	00		20:	D1	(CBx Response Data Byte 6)
..	..		21:	B5	(CBx Response Data Byte 7)
30:	00		22:	FA	(CBx Response Data Byte 8)
			23:	C7	(CBx Response Data Byte 9)
			24:	42	(CBx Response Data Byte 10)
			25:	33	(CBx Response Data Byte 11)
			26:	58	(CBx Response Data Byte 12)
			27:	A3	(CBx Response Data Byte 13)
			28:	55	(CBx Response Data Byte 14)
			29:	88	(CBx Response Data Byte 15)
			30:	49	(CBx Response Data Byte 16)
31:	83	**Data Consistency Byte (OBDCB)**	31:	8B	**Data Consistency Byte (IBDCB)**

After the Master acknowledges that it has received the fragment, the Slave places the next fragment in the Input Buffer and toggles **Bit 0** of the **IBCB** & **IBDCB**.

Since this is still not the last fragment, the Save leaves **Bit 3** set to 1 in the **IBCB** & **IBDCB**

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	83	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [1]	00	**8A**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] [1] **[0]**
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	**1C**	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	**02**	**(CBx Response Data Byte 17)**
04:	06	(CBx Command word length LSB) Minimum of 6 words	04:	**02**	**(CBx Response Data Byte 18)**
			05:	**02**	**(CBx Response Data Byte 19)**
05:	AA	(CBx Command Type) Always AA	06:	**02**	**(CBx Response Data Byte 20)**
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	07:	**02**	**(CBx Response Data Byte 21)**
			08:	**02**	**(CBx Response Data Byte 22)**
07:	00	(CBx Command, byte not used)	09:	**02**	**(CBx Response Data Byte 23)**
08:	01	(CBx Command “Node ID”)	10:	**02**	**(CBx Response Data Byte 24)**
09:	03	(CBx Command Timeout MSB)	11:	**02**	**(CBx Response Data Byte 25)**
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	12:	**02**	**(CBx Response Data Byte 26)**
			13:	**02**	**(CBx Response Data Byte 27)**
11:	00	(CBx Command Start Address MSB)	14:	**02**	**(CBx Response Data Byte 28)**
12:	00	(CBx Command Start Address LSB) address 0	15:	**02**	**(CBx Response Data Byte 29)**
			16:	**02**	**(CBx Response Data Byte 30)**
13:	00	(CBx Command Length MSB)	17:	**02**	**(CBx Response Data Byte 31)**
14:	32	(CBx Command Length LSB) 50 bytes	18:	**02**	**(CBx Response Data Byte 32)**
			19:	**02**	**(CBx Response Data Byte 33)**
15:	00		20:	**02**	**(CBx Response Data Byte 34)**
16:	00		21:	**02**	**(CBx Response Data Byte 35)**
17:	00		22:	**02**	**(CBx Response Data Byte 36)**
18:	00		23:	**02**	**(CBx Response Data Byte 37)**
19:	00		24:	**02**	**(CBx Response Data Byte 38)**
20:	00		25:	**02**	**(CBx Response Data Byte 39)**
..	..		26:	**02**	**(CBx Response Data Byte 40)**
30:	00		27:	**02**	**(CBx Response Data Byte 41)**
			28:	**02**	**(CBx Response Data Byte 42)**
			29:	**02**	**(CBx Response Data Byte 43)**
			30:	**02**	**(CBx Response Data Byte 44)**
31:	83	**Data Consistency Byte (OBDCB)**	31:	**8A**	**Data Consistency Byte (IBDCB)**

Now the Master acknowledges this fragment by toggling **Bit 0** of the **OBCB** & **OBDCB**. It knows that this is still not the last fragment of the response, since **Bit 3** of the **IBCB** & **IBDCB** is still set to 1.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**82**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] **[0]**	00	8A	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] [1] [0]
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	1C	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	02	(CBx Response Data Byte 17)
04:	06	(CBx Command word length LSB) Minimum of 6 words	04:	02	(CBx Response Data Byte 18)
			05:	02	(CBx Response Data Byte 19)
05:	AA	(CBx Command Type) Always AA	06:	02	(CBx Response Data Byte 20)
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	07:	02	(CBx Response Data Byte 21)
			08:	02	(CBx Response Data Byte 22)
07:	00	(CBx Command, byte not used)	09:	02	(CBx Response Data Byte 23)
08:	01	(CBx Command “Node ID”)	10:	02	(CBx Response Data Byte 24)
09:	03	(CBx Command Timeout MSB)	11:	02	(CBx Response Data Byte 25)
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	12:	02	(CBx Response Data Byte 26)
			13:	02	(CBx Response Data Byte 27)
11:	00	(CBx Command Start Address MSB)	14:	02	(CBx Response Data Byte 28)
12:	00	(CBx Command Start Address LSB) address 0	15:	02	(CBx Response Data Byte 29)
			16:	02	(CBx Response Data Byte 30)
13:	00	(CBx Command Length MSB)	17:	02	(CBx Response Data Byte 31)
14:	32	(CBx Command Length LSB) 50 bytes	18:	02	(CBx Response Data Byte 32)
			19:	02	(CBx Response Data Byte 33)
15:	00		20:	02	(CBx Response Data Byte 34)
16:	00		21:	02	(CBx Response Data Byte 35)
17:	00		22:	02	(CBx Response Data Byte 36)
18:	00		23:	02	(CBx Response Data Byte 37)
19:	00		24:	02	(CBx Response Data Byte 38)
20:	00		25:	02	(CBx Response Data Byte 39)
..	..		26:	02	(CBx Response Data Byte 40)
30:	00		27:	02	(CBx Response Data Byte 41)
			28:	02	(CBx Response Data Byte 42)
			29:	02	(CBx Response Data Byte 43)
			30:	02	(CBx Response Data Byte 44)
31:	**82**	**Data Consistency Byte (OBDCB)**	31:	8A	**Data Consistency Byte (IBDCB)**

Now the Slave places the final fragment into the Input Buffer and toggles **Bit 0** of the **IBCB** & **IBDCB** to indicate the new fragment is ready.

Since it is the final fragment, the Slave also now clears **Bit 3** of the **IBCB** & **IBDCB**:

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	82	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]	00	**83**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] **[0]** [0] [1] **[1]**
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	**06**	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	**02**	**(CBx Response Data Byte 45)**
04:	06	(CBx Command word length LSB) Minimum of 6 words	04:	**02**	**(CBx Response Data Byte 46)**
05:	AA	(CBx Command Type) Always AA	05:	**02**	**(CBx Response Data Byte 47)**
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	06:	**02**	**(CBx Response Data Byte 48)**
07:	00	(CBx Command, byte not used)	07:	**02**	**(CBx Response Data Byte 49)**
08:	01	(CBx Command “Node ID”)	08:	**02**	**(CBx Response Data Byte 50)**
09:	03	(CBx Command Timeout MSB)	09:	00	
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	10:	00	
11:	00	(CBx Command Start Address MSB)	11:	00	
12:	00	(CBx Command Start Address LSB) address 0	12:	00	
13:	00	(CBx Command Length MSB)	13:	00	
14:	32	(CBx Command Length LSB) 50 bytes	14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..	..		21:	00	
30:	00		22:	00	
			23:	00	
			24:	00	
			25:	00	
			26:	00	
			27:	00	
			28:	00	
			29:	00	
			30:	00	
31:	82	**Data Consistency Byte (OBDCB)**	31:	**83**	**Data Consistency Byte (IBDCB)**

And lastly, the Master acknowledges receipt of the final fragment by toggling **Bit 0** of its **OBCB** & **OBDCB**:

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
		Output Buffer Control Byte (OBCB)			**Input Buffer Control Byte (IBCB)**
00:	**83**	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] **[1]**	00	83	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [1]
01:	00	(Always 0)	01:	00	(Always 0)
02:	0C	(Packet length in bytes)	02:	06	(Packet length in bytes)
03:	00	(CBx Command word length MSB)	03:	02	(CBx Response Data Byte 45)
04:	06	(CBx Command word length LSB) Minimum of 6 words	04:	02	(CBx Response Data Byte 46)
			05:	02	(CBx Response Data Byte 47)
05:	AA	(CBx Command Type) Always AA	06:	02	(CBx Response Data Byte 48)
06:	05	(CBx Command Opcode) 0x05 = Read Tag Data	07:	02	(CBx Response Data Byte 49)
			08:	02	(CBx Response Data Byte 50)
07:	00	(CBx Command, byte not used)	09:	00	
08:	01	(CBx Command “Node ID”)	10:	00	
09:	03	(CBx Command Timeout MSB)	11:	00	
10:	E8	(CBx Command Timeout LSB) 0xE8 = 1000 ms timeout	12:	00	
			13:	00	
11:	00	(CBx Command Start Address MSB)	14:	00	
12:	00	(CBx Command Start Address LSB) address 0	15:	00	
			16:	00	
13:	00	(CBx Command Length MSB)	17:	00	
14:	32	(CBx Command Length LSB) 50 bytes	18:	00	
			19:	00	
15:	00		20:	00	
16:	00		21:	00	
17:	00		22:	00	
18:	00		23:	00	
19:	00		24:	00	
20:	00		25:	00	
..	..		26:	00	
30:	00		27:	00	
			28:	00	
			29:	00	
			30:	00	
31:	**83**	**Data Consistency Byte (OBDCB)**	31:	83	**Data Consistency Byte (IBDCB)**

The command/response sequence has completed. A command has been issued and the response received and all fragments of a response have been retrieved and acknowledged.

9.5.4 Example 4: Fragmentation of Commands

For this example, the Master will send a CBx “Write Tag Data” command to the Slave (the BIS M-622 Processor unit) to write 50 bytes to a tag.

We will assume for this example that the both the input and output buffers have been configured to 32 bytes each. This means that the command itself cannot completely fit in the output buffer, and therefore needs to be sent in fragments. Long Tag writes that exceed the buffer size can be separated into multiple writes, with each write addressed to a different location of the tag, but if it is desirable to send one long CBx command, it can be accomplished using this method of fragmentation:

Sending the command:

In **Byte 2** of the output buffer the Master places the length (in bytes) of the data packet (first Fragment of the CBx Command) we are sending – in this case the first fragment will be 28 bytes – the maximum size of a packet when the output buffer is 32 bytes.

(The entire CBx command we are planning to send, over 3 fragments, is 62 bytes).

In **Byte 3** through **Byte 30** the Master places the first 28 bytes of this CBx command.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	80	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	**1C**	**(Packet length in bytes)**	02:	00	
03:	**00**	**(CBx Command word length MSB)**	03:	00	
04:	**1F**	**(CBx Command word length LSB)**	04:	00	
05:	**AA**	**(CBx Command Type)** Always AA	05:	00	
06:	**06**	**(CBx Command Opcode)** 0x06 = Write Tag Data	06:	00	
			07:	00	
07:	**00**	**(CBx Command, byte not used)**	08:	00	
08:	**01**	**(CBx Command “Node ID”)**	09:	00	
09:	**03**	**(CBx Command Timeout MSB)**	10:	00	
10:	**E8**	**(CBx Command Timeout LSB)** 0xE8 = 1000 ms timeout	11:	00	
			12:	00	
11:	**00**	**(CBx Command Start Address MSB)**	13:	00	
12:	**00**	**(CBx Command Start Address LSB)** address 0	14:	00	
			15:	00	
13:	**00**	**(CBx Command Length MSB)**	16:	00	
14:	**32**	**(CBx Command Length LSB)** 50 bytes	17:	00	
			18:	00	
15:	**41**	**(CBx Command Data Byte 1)**	19:	00	
16:	**42**	**(CBx Command Data Byte 2)**	20:	00	
17:	**43**	**(CBx Command Data Byte 3)**	..	..	
18:	**44**	**(CBx Command Data Byte 4)**	30:	00	
19:	**45**	**(CBx Command Data Byte 5)**			
20:	**46**	**(CBx Command Data Byte 6)**			
21:	**47**	**(CBx Command Data Byte 7)**			
22:	**48**	**(CBx Command Data Byte 8)**			
23:	**49**	**(CBx Command Data Byte 9)**			
24:	**50**	**(CBx Command Data Byte 10)**			
25:	**51**	**(CBx Command Data Byte 11)**			
26:	**52**	**(CBx Command Data Byte 12)**			
27:	**53**	**(CBx Command Data Byte 13)**			
28:	**54**	**(CBx Command Data Byte 14)**			
29:	**55**	**(CBx Command Data Byte 15)**			
30:	**56**	**(CBx Command Data Byte 16)**			
31:	80	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

Now that the first command fragment is in the Output Buffer, the Master alerts the Slave that the command fragment is ready. It does this by toggling **Bit 1** of the **OBCB** & **OBDCB**.

Since there are more command fragments to follow to complete the command, the Master also sets **Bit 3** of the **OBCB** & **OBDCB** to 1. This bit is what tells the Slave to wait for further fragments before processing the command.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
		Output Buffer Control Byte (OBCB)			**Input Buffer Control Byte (IBCB)**
00:	**8A**	7 6 5 4 3 2 1 0 [1] [0] [0] [0] **[1]** [0] **[1]** [0]	00	80	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	1C	(Packet length in bytes)	02:	00	
03:	00	(CBx Command word length MSB)	03:	00	
04:	1F	(CBx Command word length LSB)	04:	00	
05:	AA	(CBx Command Type) Always AA	05:	00	
06:	06	(CBx Command Opcode)	06:	00	
		0x06 = Write Tag Data	07:	00	
07:	00	(CBx Command, byte not used)	08:	00	
08:	01	(CBx Command “Node ID”)	09:	00	
09:	03	(CBx Command Timeout MSB)	10:	00	
10:	E8	(CBx Command Timeout LSB)	11:	00	
		0xE8 = 1000 ms timeout	12:	00	
11:	00	(CBx Command Start Address MSB)	13:	00	
12:	00	(CBx Command Start Address LSB)	14:	00	
		address 0	15:	00	
13:	00	(CBx Command Length MSB)	16:	00	
14:	32	(CBx Command Length LSB)	17:	00	
		50 bytes	18:	00	
15:	41	(CBx Command Data Byte 1)	19:	00	
16:	42	(CBx Command Data Byte 2)	20:	00	
17:	43	(CBx Command Data Byte 3)	..	..	
18:	44	(CBx Command Data Byte 4)	30:	00	
19:	45	(CBx Command Data Byte 5)			
20:	46	(CBx Command Data Byte 6)			
21:	47	(CBx Command Data Byte 7)			
22:	48	(CBx Command Data Byte 8)			
23:	49	(CBx Command Data Byte 9)			
24:	50	(CBx Command Data Byte 10)			
25:	51	(CBx Command Data Byte 11)			
26:	52	(CBx Command Data Byte 12)			
27:	53	(CBx Command Data Byte 13)			
28:	54	(CBx Command Data Byte 14)			
29:	55	(CBx Command Data Byte 15)			
30:	56	(CBx Command Data Byte 16)			
31:	**8A**	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

When the Slave sees Bit 1 of the **OBCB** & **OBDBC** toggle, it grabs the command fragment from the **Output Buffer.** The Slave then acknowledges the command fragment by toggling **Bit 1** of the **IBCB** & **IBDCB**.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
		Output Buffer Control Byte (OBCB)			**Input Buffer Control Byte (IBCB)**
00:	8A	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] [1] [0]	00	**82**	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1]** [0]
01:	00	(Always 0)	01:	00	
02:	1C	(Packet length in bytes)	02:	00	
03:	00	(CBx Command word length MSB)	03:	00	
04:	1F	(CBx Command word length LSB)	04:	00	
05:	AA	(CBx Command Type) Always AA	05:	00	
06:	06	(CBx Command Opcode)	06:	00	
		0x06 = Write Tag Data	07:	00	
07:	00	(CBx Command, byte not used)	08:	00	
08:	01	(CBx Command “Node ID”)	09:	00	
09:	03	(CBx Command Timeout MSB)	10:	00	
10:	E8	(CBx Command Timeout LSB)	11:	00	
		0xE8 = 1000 ms timeout	12:	00	
11:	00	(CBx Command Start Address MSB)	13:	00	
12:	00	(CBx Command Start Address LSB)	14:	00	
		address 0	15:	00	
13:	00	(CBx Command Length MSB)	16:	00	
14:	32	(CBx Command Length LSB)	17:	00	
		50 bytes	18:	00	
15:	41	(CBx Command Data Byte 1)	19:	00	
16:	42	(CBx Command Data Byte 2)	20:	00	
17:	43	(CBx Command Data Byte 3)	..	..	
18:	44	(CBx Command Data Byte 4)	30:	00	
19:	45	(CBx Command Data Byte 5)			
20:	46	(CBx Command Data Byte 6)			
21:	47	(CBx Command Data Byte 7)			
22:	48	(CBx Command Data Byte 8)			
23:	49	(CBx Command Data Byte 9)			
24:	50	(CBx Command Data Byte 10)			
25:	51	(CBx Command Data Byte 11)			
26:	52	(CBx Command Data Byte 12)			
27:	53	(CBx Command Data Byte 13)			
28:	54	(CBx Command Data Byte 14)			
29:	55	(CBx Command Data Byte 15)			
30:	56	(CBx Command Data Byte 16)			
31:	8A	**Data Consistency Byte (OBDCB)**	31:	**82**	**Data Consistency Byte (IBDCB)**

Now that the Slave has acknowledged receiving the command fragment, the Master writes the next command fragment into the Output Buffer:

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	8A	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] [1] [0]	00	82	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]
01:	00	(Always 0)	01:	00	
02:	**1C**	**(Packet length in bytes)**	02:	00	
03:	**57**	**(CBx Command Data Byte 17)**	03:	00	
04:	**58**	**(CBx Command Data Byte 18)**	04:	00	
05:	**59**	**(CBx Command Data Byte 19)**	05:	00	
06:	**60**	**(CBx Command Data Byte 20)**	06:	00	
07:	**61**	**(CBx Command Data Byte 21)**	07:	00	
08:	**62**	**(CBx Command Data Byte 22)**	08:	00	
09:	**63**	**(CBx Command Data Byte 23)**	09:	00	
10:	**64**	**(CBx Command Data Byte 24)**	10:	00	
11:	**65**	**(CBx Command Data Byte 25)**	11:	00	
12:	**66**	**(CBx Command Data Byte 26)**	12:	00	
13:	**67**	**(CBx Command Data Byte 27)**	13:	00	
14:	**68**	**(CBx Command Data Byte 28)**	14:	00	
15:	**69**	**(CBx Command Data Byte 29)**	15:	00	
16:	**70**	**(CBx Command Data Byte 30)**	16:	00	
17:	**71**	**(CBx Command Data Byte 31)**	17:	00	
18:	**72**	**(CBx Command Data Byte 32)**	18:	00	
19:	**73**	**(CBx Command Data Byte 33)**	19:	00	
20:	**74**	**(CBx Command Data Byte 34)**	20:	00	
21:	**75**	**(CBx Command Data Byte 35)**	..	..	
22:	**76**	**(CBx Command Data Byte 36)**	30:	00	
23:	**77**	**(CBx Command Data Byte 37)**			
24:	**78**	**(CBx Command Data Byte 38)**			
25:	**79**	**(CBx Command Data Byte 39)**			
26:	**80**	**(CBx Command Data Byte 40)**			
27:	**81**	**(CBx Command Data Byte 41)**			
28:	**82**	**(CBx Command Data Byte 42)**			
29:	**83**	**(CBx Command Data Byte 43)**			
30:	**84**	**(CBx Command Data Byte 44)**			
31:	8A	**Data Consistency Byte (OBDCB)**	31:	82	**Data Consistency Byte (IBDCB)**

Next, the Master signals that this fragment is ready, by toggling **Bit 1** of the **OBCB** & **OBDCB**. Since this is still not the final fragment, the Master leaves **Bit 3** set to 1.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	**88**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] **[0]** [0]	00	82	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]
01:	00	(Always 0)	01:	00	
02:	1C	(Packet length in bytes)	02:	00	
03:	57	(CBx Command Data Byte 17)	03:	00	
04:	58	(CBx Command Data Byte 18)	04:	00	
05:	59	(CBx Command Data Byte 19)	05:	00	
06:	60	(CBx Command Data Byte 20)	06:	00	
07:	61	(CBx Command Data Byte 21)	07:	00	
08:	62	(CBx Command Data Byte 22)	08:	00	
09:	63	(CBx Command Data Byte 23)	09:	00	
10:	64	(CBx Command Data Byte 24)	10:	00	
11:	65	(CBx Command Data Byte 25)	11:	00	
12:	66	(CBx Command Data Byte 26)	12:	00	
13:	67	(CBx Command Data Byte 27)	13:	00	
14:	68	(CBx Command Data Byte 28)	14:	00	
15:	69	(CBx Command Data Byte 29)	15:	00	
16:	70	(CBx Command Data Byte 30)	16:	00	
17:	71	(CBx Command Data Byte 31)	17:	00	
18:	72	(CBx Command Data Byte 32)	18:	00	
19:	73	(CBx Command Data Byte 33)	19:	00	
20:	74	(CBx Command Data Byte 34)	20:	00	
21:	75	(CBx Command Data Byte 35)	..	..	
22:	76	(CBx Command Data Byte 36)	30:	00	
23:	77	(CBx Command Data Byte 37)			
24:	78	(CBx Command Data Byte 38)			
25:	79	(CBx Command Data Byte 39)			
26:	80	(CBx Command Data Byte 40)			
27:	81	(CBx Command Data Byte 41)			
28:	82	(CBx Command Data Byte 42)			
29:	83	(CBx Command Data Byte 43)			
30:	84	(CBx Command Data Byte 44)			
31:	**88**	**Data Consistency Byte (OBDCB)**	31:	82	**Data Consistency Byte (IBDCB)**

When the Slave sees Bit 1 of the **OBCB** & **OBDBC** toggle, it grabs this command fragment from the Output Buffer. The Slave then acknowledges the command fragment by toggling **Bit 1** of the **IBCB** & **IBDCB**.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	88	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] [0] [0]	00	**80**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[0]** [0]
01:	00	(Always 0)	01:	00	
02:	1C	(Packet length in bytes)	02:	00	
03:	57	(CBx Command Data Byte 17)	03:	00	
04:	58	(CBx Command Data Byte 18)	04:	00	
05:	59	(CBx Command Data Byte 19)	05:	00	
06:	60	(CBx Command Data Byte 20)	06:	00	
07:	61	(CBx Command Data Byte 21)	07:	00	
08:	62	(CBx Command Data Byte 22)	08:	00	
09:	63	(CBx Command Data Byte 23)	09:	00	
10:	64	(CBx Command Data Byte 24)	10:	00	
11:	65	(CBx Command Data Byte 25)	11:	00	
12:	66	(CBx Command Data Byte 26)	12:	00	
13:	67	(CBx Command Data Byte 27)	13:	00	
14:	68	(CBx Command Data Byte 28)	14:	00	
15:	69	(CBx Command Data Byte 29)	15:	00	
16:	70	(CBx Command Data Byte 30)	16:	00	
17:	71	(CBx Command Data Byte 31)	17:	00	
18:	72	(CBx Command Data Byte 32)	18:	00	
19:	73	(CBx Command Data Byte 33)	19:	00	
20:	74	(CBx Command Data Byte 34)	20:	00	
21:	75	(CBx Command Data Byte 35)	..	..	
22:	76	(CBx Command Data Byte 36)	30:	00	
23:	77	(CBx Command Data Byte 37)			
24:	78	(CBx Command Data Byte 38)			
25:	79	(CBx Command Data Byte 39)			
26:	80	(CBx Command Data Byte 40)			
27:	81	(CBx Command Data Byte 41)			
28:	82	(CBx Command Data Byte 42)			
29:	83	(CBx Command Data Byte 43)			
30:	84	(CBx Command Data Byte 44)			
31:	88	**Data Consistency Byte (OBDCB)**	31:	**80**	**Data Consistency Byte (IBDCB)**

Now that the Slave has acknowledged receiving the command fragment, the Master writes the next (and final) command fragment into the Output Buffer:

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	88	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [1] [0] [0] [0]	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	**06**	**(Packet length in bytes)**	02:	00	
03:	**85**	**(CBx Command Data Byte 45)**	03:	00	
04:	**86**	**(CBx Command Data Byte 46)**	04:	00	
05:	**87**	**(CBx Command Data Byte 47)**	05:	00	
06:	**88**	**(CBx Command Data Byte 48)**	06:	00	
07:	**89**	**(CBx Command Data Byte 49)**	07:	00	
08:	**90**	**(CBx Command Data Byte 50)**	08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
21:	00		..	..	
22:	00		30:	00	
23:	00				
24:	00				
25:	00				
26:	00				
27:	00				
28:	00				
29:	00				
30:	00				
31:	88	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

Next, the Master signals that this fragment is ready, by toggling **Bit 1** of the **OBCB** & **OBDCB**. Since this **is** the final fragment, the Master clears **Bit 3** to 0.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**82**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] **[0]** [0] **[1]** [0]	00	80	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	00	
03:	85	(CBx Command Data Byte 45)	03:	00	
04:	86	(CBx Command Data Byte 46)	04:	00	
05:	87	(CBx Command Data Byte 47)	05:	00	
06:	88	(CBx Command Data Byte 48)	06:	00	
07:	89	(CBx Command Data Byte 49)	07:	00	
08:	90	(CBx Command Data Byte 50)	08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
21:	00		..	..	
22:	00		30:	00	
23:	00				
24:	00				
25:	00				
26:	00				
27:	00				
28:	00				
29:	00				
30:	00				
31:	**82**	**Data Consistency Byte (OBDCB)**	31:	80	**Data Consistency Byte (IBDCB)**

When the Slave sees Bit 1 of the **OBCB** & **OBDBC** toggle, it grabs this command fragment from the Output Buffer. The Slave then acknowledges the command fragment by toggling **Bit 1** of the **IBCB** & **IBDCB**.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	82	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]	00	**82**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1]** [0]
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	00	
03:	85	(CBx Command Data Byte 45)	03:	00	
04:	86	(CBx Command Data Byte 46)	04:	00	
05:	87	(CBx Command Data Byte 47)	05:	00	
06:	88	(CBx Command Data Byte 48)	06:	00	
07:	89	(CBx Command Data Byte 49)	07:	00	
08:	90	(CBx Command Data Byte 50)	08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
21:	00		..	..	
22:	00		30:	00	
23:	00				
24:	00				
25:	00				
26:	00				
27:	00				
28:	00				
29:	00				
30:	00				
31:	82	**Data Consistency Byte (OBDCB)**	31:	**82**	**Data Consistency Byte (IBDCB)**

The Slave, at this point, after acknowledging the final fragment, knows it has the complete CBx command, so it processes the command.

Assuming the command is successful, the Slave will write the response (in this case a “Tag Write Successful” response) into the Input buffer, and then toggle **Bit 0** of the **IBCB** & **IBDCB**.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
		Output Buffer Control Byte (OBCB)			**Input Buffer Control Byte (IBCB)**
00:	82	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]	00	**83**	7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] **[1] [1]**
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	**0C**	**(Packet length in bytes)**
03:	85	(CBx Command Data Byte 45)	03:	**00**	**(CBx Response word length MSB)**
04:	86	(CBx Command Data Byte 46)	04:	**06**	**(CBx Response word length LSB)**
05:	87	(CBx Command Data Byte 47)			Minimum of 6 words
06:	88	(CBx Command Data Byte 48)	05:	**AA**	**(CBx Response Type)**
07:	89	(CBx Command Data Byte 49)			AA=Normal Response
08:	90	(CBx Command Data Byte 50)	06:	**06**	**(CBx Response Opcode)**
09:	00				06=echo of "Tag Write"
10:	00		07:	**01**	**(CBx Response Instance Counter)**
11:	00		08:	**01**	**(CBx Response “Node ID”)**
12:	00		09:	**01**	**(CBx Response Timestamp Month)**
13:	00		10:	**01**	**(CBx Response Timestamp Day)**
14:	00		11:	**00**	**(CBx Response Timestamp Hour)**
15:	00		12:	**01**	**(CBx Response Timestamp Minute)**
16:	00		13:	**20**	**(CBx Response Timestamp Second)**
17:	00		14:	**00**	**(CBx Response Not Used)**
18:	00		15:	00	
19:	00		16:	00	
20:	00		17:	00	
21:	00		18:	00	
22:	00		19:	00	
23:	00		20:	00	
24:	00		..	..	
25:	00		30:	00	
26:	00				
27:	00				
28:	00				
29:	00				
30:	00				
31:	82	**Data Consistency Byte (OBDCB)**	31:	**83**	**Data Consistency Byte (IBDCB)**

The Master now toggles **Bit 0** of the **OBCB** & **OBDCB** to acknowledge that it has received the response.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	**83**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] **[1]**	00	83	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [1]
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	0C	(Packet length in bytes)
03:	85	(CBx Command Data Byte 45)	03:	00	(CBx Response word length MSB)
04:	86	(CBx Command Data Byte 46)	04:	06	(CBx Response word length LSB) Minimum of 6 words
05:	87	(CBx Command Data Byte 47)			
06:	88	(CBx Command Data Byte 48)	05:	AA	(CBx Response Type) AA=Normal Response
07:	89	(CBx Command Data Byte 49)			
08:	90	(CBx Command Data Byte 50)	06:	06	(CBx Response Opcode) 06=echo of "Tag Write"
09:	00				
10:	00		07:	01	(CBx Response Instance Counter)
11:	00		08:	01	(CBx Response “Node ID”)
12:	00		09:	01	(CBx Response Timestamp Month)
13:	00		10:	01	(CBx Response Timestamp Day)
14:	00		11:	00	(CBx Response Timestamp Hour)
15:	00		12:	01	(CBx Response Timestamp Minute)
16:	00		13:	20	(CBx Response Timestamp Second)
17:	00		14:	00	(CBx Response Not Used)
18:	00		15:	00	
19:	00		16:	00	
20:	00		17:	00	
21:	00		18:	00	
22:	00		19:	00	
23:	00		20:	00	
24:	00		..	..	
25:	00		30:	00	
26:	00				
27:	00				
28:	00				
29:	00				
30:	00				
31:	**83**	**Data Consistency Byte (OBDCB)**	31:	83	**Data Consistency Byte (IBDCB)**

The command/response sequence has completed. A command has been issued over 3 fragments and processed, and the response received and the response has been acknowledged.

9.5.5 Example 5: Resynchronization

For this example we will assume the same conditions as the previous example, that the input buffer and output buffer are 32 bytes each.

It does not matter what data is currently in the two buffers, other than the control bytes and data consistency bytes – resynchronization only resets the handshaking to a known state.

For this example we will assume a starting state as follows:

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	80	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]	00	82	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	00	
03:	00		03:	00	
04:	00		04:	00	
05:	00		05:	00	
06:	00		06:	00	
07:	00		07:	00	
08:	00		08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..			..	..	
30:			30:	00	
31:	80	**Data Consistency Byte (OBDCB)**	31:	82	**Data Consistency Byte (IBDCB)**

If the Master believes that the handshaking has gotten out of synch, it can request a resynchronization, by setting **Bit 2** of the **Output Buffer Control Byte (**the **OBCB)** and then also setting the same bit in the **Output Buffer Data Consistency Byte** (the **OBDCB**).

NOTE

Bit 2 is not a toggle – It is always set to 1 to begin a resynchronization process, and cleared later to acknowledge that the process is complete.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	**84**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] **[1]** [0] [0]	00	82	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [1] [0]
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	00	
03:	00		03:	00	
04:	00		04:	00	
05:	00		05:	00	
06:	00		06:	00	
07:	00		07:	00	
08:	00		08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..			..	..	
30:			30:	00	
31:	**84**	**Data Consistency Byte (OBDCB)**	31:	82	**Data Consistency Byte (IBDCB)**

When the slave sees **Bit 2** In the **OBCB** & **OBDCB** set, it knows it needs to resynchronize its handshaking bits in the **IBCB** & **IBDCB.**

So the Slave will acknowledge the resynchronization request by setting **Bit 2,** and will clear **Bit 1** and **Bit 0** in the **IBCB** & **IBDCB**.

Note that whatever values Bit 1 or Bit 0 had, they will be set to 0. This process forces the handshaking into a known state.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	84	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [1] [0] [0]	00	**84**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] **[1] [0] [0]**
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	00	
03:	00		03:	00	
04:	00		04:	00	
05:	00		05:	00	
06:	00		06:	00	
07:	00		07:	00	
08:	00		08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..			..	..	
30:			30:	00	
31:	84	**Data Consistency Byte (OBDCB)**	31:	**84**	**Data Consistency Byte (IBDCB)**

When the Master sees **Bit 2** of the **IBCB** & **IBDCB** set, it clears **Bit 2** of the **OBCB** & **OBDCB** to acknowledge that the Slave has resynchronized.

(See the **Green** changes below)

Output Buffer			Input Buffer		
Byte #	**Value**		**Byte #**	**Value**	
00:	**80**	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] **[0]** [0] [0]	00	84	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [1] [0] [0]
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	00	
03:	00		03:	00	
04:	00		04:	00	
05:	00		05:	00	
06:	00		06:	00	
07:	00		07:	00	
08:	00		08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..			..	..	
30:			30:	00	
31:	**80**	**Data Consistency Byte (OBDCB)**	31:	84	**Data Consistency Byte (IBDCB)**

And lastly, when the Slave sees the Master clear **Bit 2** of the **OBCD** & **OBCDB**, it clears **Bit 2** of the **IBCB** & **IBDCB** to complete the resynchronization process.

(See the **Green** changes below)

Output Buffer			**Input Buffer**		
Byte #	**Value**		**Byte #**	**Value**	
00:	80	**Output Buffer Control Byte (OBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] [0] [0] [0]	00	**80**	**Input Buffer Control Byte (IBCB)** 7 6 5 4 3 2 1 0 [1] [0] [0] [0] [0] **[0]** [0] [0]
01:	00	(Always 0)	01:	00	
02:	06	(Packet length in bytes)	02:	00	
03:	00		03:	00	
04:	00		04:	00	
05:	00		05:	00	
06:	00		06:	00	
07:	00		07:	00	
08:	00		08:	00	
09:	00		09:	00	
10:	00		10:	00	
11:	00		11:	00	
12:	00		12:	00	
13:	00		13:	00	
14:	00		14:	00	
15:	00		15:	00	
16:	00		16:	00	
17:	00		17:	00	
18:	00		18:	00	
19:	00		19:	00	
20:	00		20:	00	
..			..	..	
30:			30:	00	
31:	80	**Data Consistency Byte (OBDCB)**	31:	**80**	**Data Consistency Byte (IBDCB)**

The Resynchronization process is complete. The Slave is now in a known state, with the handshake bits set to zero, and internally in a state of “waiting for a new command”.

10 PROFINET INTERFACE

NOTE

For BIS M-628-075-A01-03-ST34 models.

10.1 PROFINET OVERVIEW

Profinet is the open industrial Ethernet standard of PROFIBUS & PROFINET International (PI) for automation. Profinet uses TCP/IP and IT standards, and is, in effect, real-time Ethernet. The Profinet concept features a modular structure so that users can select the cascading functions themselves. They differ essentially because of the type of data exchange to fulfill the partly very high requirements of speed. Profinet is defined by PROFIBUS & PROFINET International (PI) and backed by the INTERBUS Club and, since 2003, is part of the IEC 61158 and IEC 61784 standards.

10.2 PROFINET IO

In conjunction with PROFINET, the two perspectives PROFINET CBA and PROFINET IO exist.

PROFINET CBA
Suitable for component-based communication via TCP/IP and real-time communication for real-time requirements in modular systems engineering.

PROFINET IO
Developed for real time (RT) and isochronous real time (IRT) communication with decentral periphery. The designations RT and IRT merely describe the real-time properties for the communication within PROFINET IO.

The Profinet Controller supports **Profinet IO**:

MAIN FEATURES:

- Complies to conformance class B
- Device characteristics stored in a .GSD file, used by PROFINET engineering tools when setting up the network configuration.
- 100Mbps, full duplex with auto-negotiation enabled as default
- Up to 248 bytes of IO Data

10.3 DATA EXCHANGE

The Master Profinet is usually a PLC (Siemens S7 or others) but it could be a PC based device as well. The Profinet Controller is always Slave in the Profinet network.

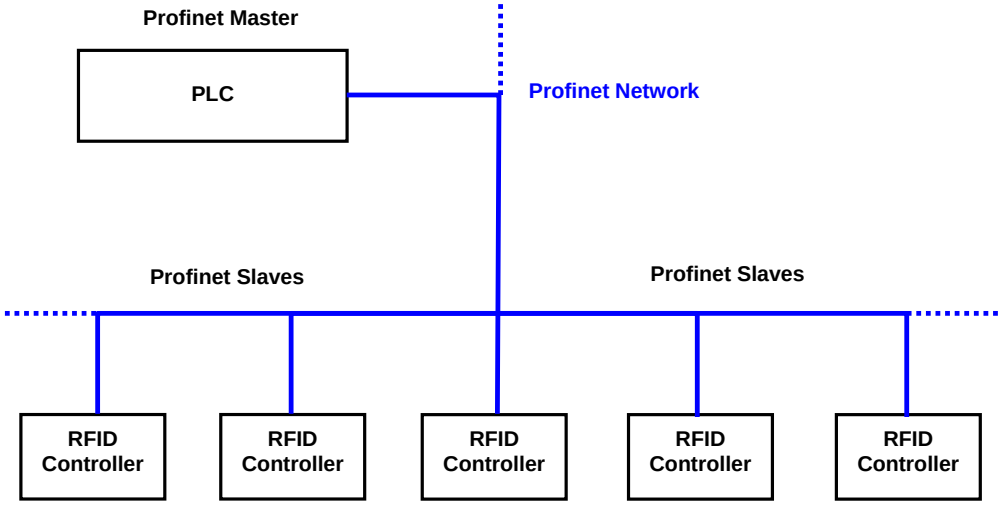


Figure 73 - Profinet IO Network Diagram

Basically two shared memory areas (Exchange Areas) are used to exchange information between the SLAVE and the MASTER, both devices provide information to each other.

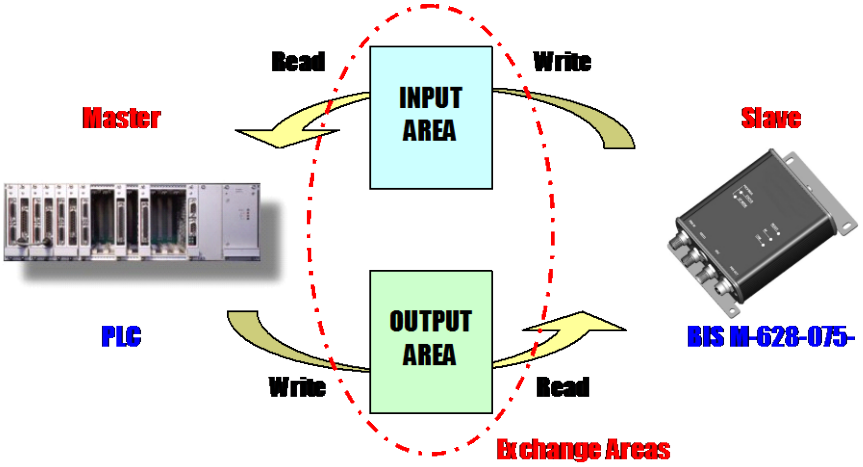


Figure 74 - Profinet Communication – Data Exchange Areas Diagram

Input and Output areas always refer to the Master: this means that the Controller writes to the Input buffer and the PLC writes to the Output buffer.

The dimension of the exchange areas can be set to different values by the PLC through the GSD file: the Profinet Controller allows up to **248 bytes as a combined total of the Input and Output Areas**.

NOTE	*For further information regarding Fieldbus interfacing including downloadable support files, go to the HMS website at http://www.anybus.com, choose the link to the support page, select the* Anybus-CompactCom product type *and then your* network type.

10.4 PROTOCOL IMPLEMENTATION

10.4.1 Definitions

In the protocol description we'll use the following definitions:

- Input field: is the set of master inputs that can be modified by the specific slave
- Output field: is the set of master outputs that can be read by the specific slave
- MaxInBytes: is the number of input bytes shared by the master and the specific slave
- MaxOutBytes: is the number of output bytes shared by the master and the specific slave
- IN[Nin] represent the input byte number Nin, where numbering starts from 0 to MaxInBytes-1
- OUT[Nout] represent the output byte number Nout, where numbering starts from 0 to MaxOutBytes-1

Obviously, MaxInBytes and MaxOutBytes are respectively the configured **INPUT** and **OUTPUT AREA** sizes.

The I/O Exchange Areas are actually updated and read every 30 ms at the Profinet Controller side. So after an RFID tag is read the worst delivery time from the Profinet Controller to the Master station is about 30 ms plus the intrinsic PROFINET IO delay and the Master delay.

This product implements the Balluff AnyBus Protocol which is a layer that is built upon the intrinsic fieldbus data exchange mechanism. The Driver is needed to add features such as flow control and fragmentation.

In order to implement the flow controlled version of the driver, I/O Exchange Areas must be congruently compiled in both directions. **INPUT** Area is the Exchange buffer from Profinet Controller to the Master while **OUTPUT** Area is the exchange buffer from the Master to the Profinet Controller. Only the first three bytes are used by the Balluff AnyBus Protocol layer in both buffers for the extended protocol.

These are:

byte 0: **Control Field**, used to issue and control the Balluff AnyBus Protocol primitives such as flowcontrol, fragmentation and resynchronization;

byte 1: **Service Access Point Field**, used to distinguish among different services but also to provide future expandability. Since this SAP definition is introduced by the Balluff AnyBus Protocol, it must not be confused with the AnyBus SAP that is defined by the international standard.

byte 2: **Length Field**, that contains the number of bytes used by the application layer. This number must always be less than or equal to MaxInBytes-3 for the IN[ ] buffer and less than or equal to MaxOutBytes-3 for the OUT[ ] buffer.

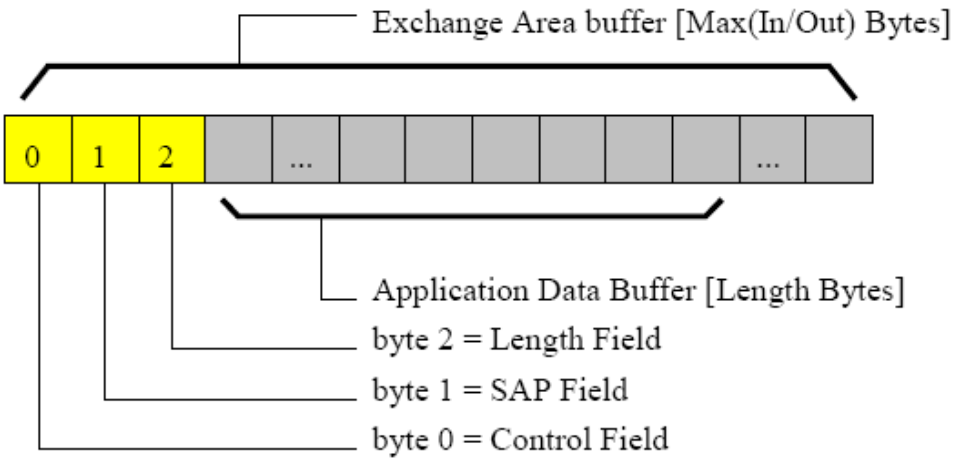


Figure 75 - Exchange Area Buffer Structure

10.4.2 Control Field

The Input field structure reserves IN[0] for handshake purposes: bit 0 and bit 1 are used for this. Bit 6 is set to 1 in order to specify the messaging protocol number 1 is in use. The Output field structure is symmetrical, and reserves bit 0 and 1 for handshake purposes. Bit 6 is set to 1 in order to specify the messaging protocol number 1 is in use. Bit 2 of the Output buffer is used to request a clear of the synchronization numbers (bit 0 and bit 1 of both Input and Output buffers).

This is called a resynchronization request and it is always initiated by the Master Station. The Slave must acknowledge the request, using bit 2 of the Input buffer. Bit 3 is used to control a fragmentation sequence in both directions.

More precisely,

<u>function of the IN[0] byte:</u>

IN[0].bit0 = TxBufferFull, toggles when new data is available on IN[1] .. IN[Nin] input area

IN[0].bit1 = RxBufferEmpty, toggles when rx block has been read on OUT[1] .. OUT[Nout]

IN[0].bit2 = Resync Acknowledge, set to 1 as an acknowledge to a resync request.

IN[0].bit3 = More Bit, it must be set to 1 when this is not the last piece of a fragmentation sequence. It must be set to 0 when this is the last piece of a fragmentation sequence.

IN[0].bit4,5,7 = set to 0,0,0 when this messaging protocol is used.

IN[0].bit6 = set to 1 when this messaging protocol is used.

function of the OUT[0] byte:

OUT[0].bit0 = TxBufferEmpty, toggles when transmitted data block has been read from master.

OUT[0].bit1 = RxBufferFull, toggles when new data block is available from master.

OUT[0].bit2 = Resync Request, set to 1 for 1 second to resynchronize a slave. After

resynchronization, all 4 handshake bits are set to 0 and next toggle brings them to 1.

OUT[0].bit3 = More Bit, it must be set to 1 when this is not the last piece of a fragmentation sequence. It must be set to 0 when this is the last piece of a fragmentation sequence.

OUT[0].bit4,5,7 = set to 0,0,0 when this messaging protocol is used.

OUT[0].bit6 = set to 1 when this messaging protocol is used.

The following figure shows how it is possible to exchange messages with flow control using bit 0 and bit 1 in the IN/OUT buffers.

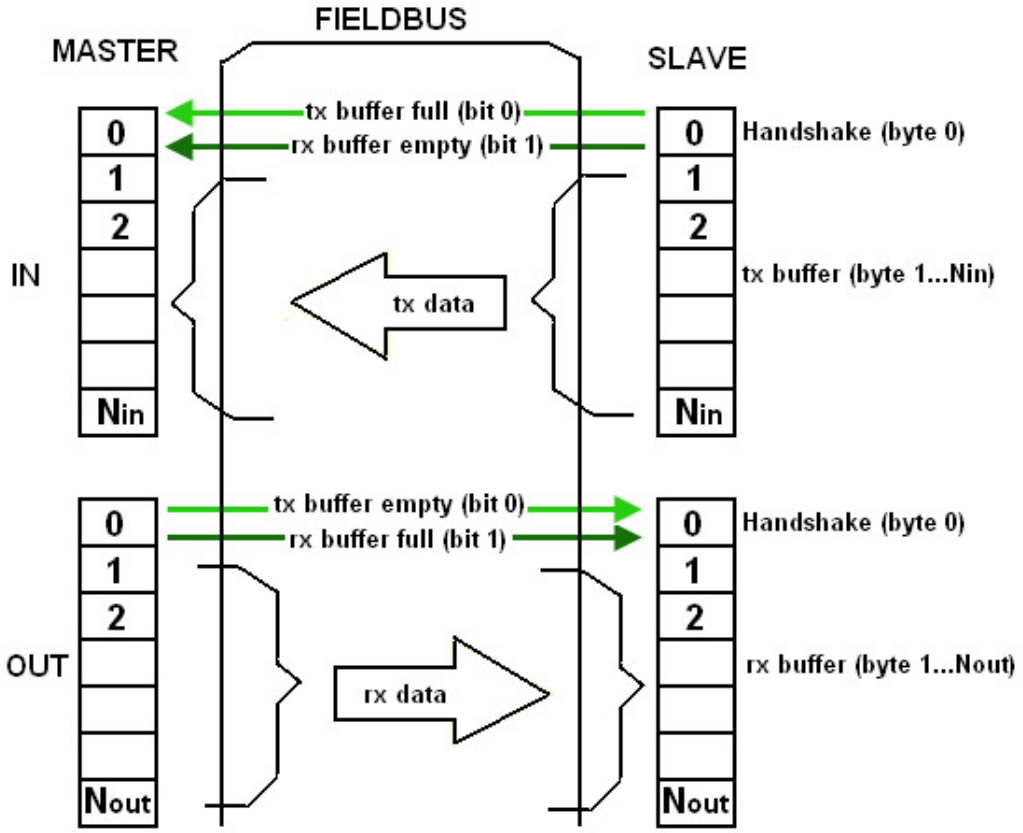


Figure 76 - Message Exchange with Flow Control

Data Transmission Slave → Master

The transmission state machine is shown to understand how a single block is transmitted and received. This protocol guarantees a basic flow control mechanism from slave to master.

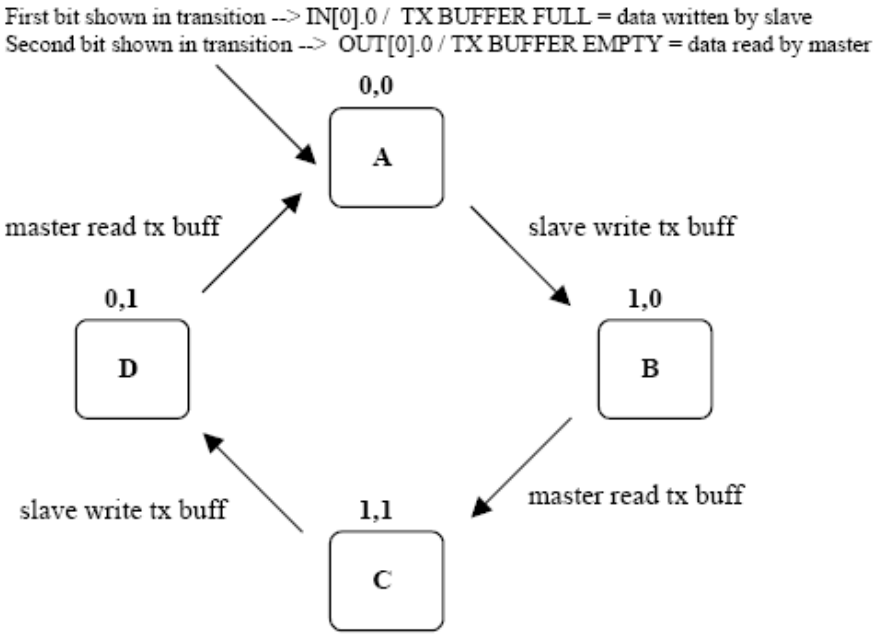

First bit shown in transition --> IN[0].0 / TX BUFFER FULL = data written by slave
Second bit shown in transition --> OUT[0].0 / TX BUFFER EMPTY = data read by master
0,0
A
master read tx buff
slave write tx buff
0,1
D
1,0
B
slave write tx buff
1,1
C
master read tx buff

Figure 77 - Slave to Master Transmission State Machine

Data Transmission Master → Slave

The receive state machine is shown to understand how a single block is transmitted by the master and received by a slave. This protocol guarantees a basic flow control mechanism from master to slave.

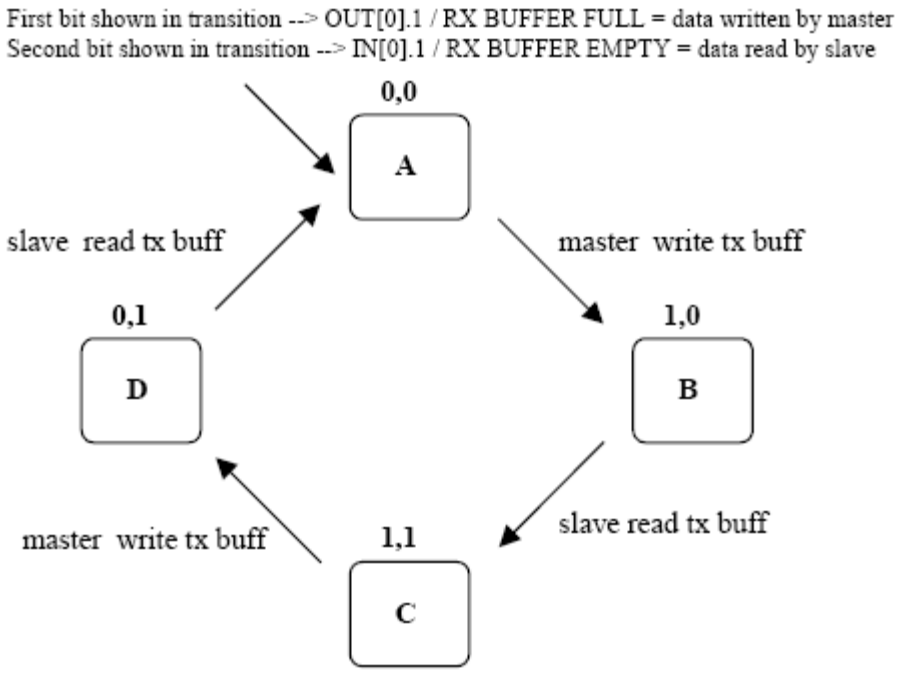

First bit shown in transition --> OUT[0].1 / RX BUFFER FULL = data written by master
Second bit shown in transition --> IN[0].1 / RX BUFFER EMPTY = data read by slave
0,0
A
slave read tx buff
master write tx buff
0,1
D
1,0
B
master write tx buff
1,1
C
slave read tx buff

Figure 78 - Master to Slave Reception State Machine

Resynchronization Protocol

Resynchronization may be used at the master startup, both to detect if a slave is on line or not, or to restart the messaging protocol from a predefined state. It is also used during normal operations in case of errors requiring a protocol reset procedure to be started.

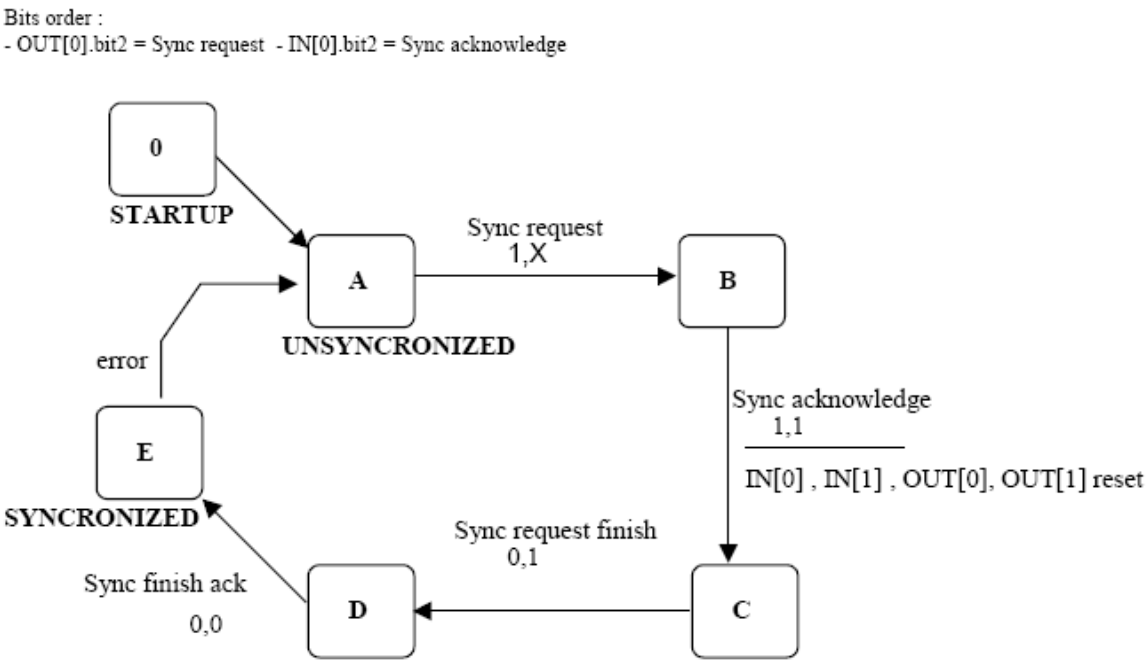


Figure 79 - Resynchronization State Machine

10.4.3 SAP Field

SAP (Service Access Point) is an identifier that is used to share the same communication channel between processes of two remote stations. This allows splitting the single service into different services.

SAP = 0 is actually used by the slave to transfer acquisition information; it should also be used to transfer application data from Master to Slave.

SAP = 2 is currently reserved.

SAP = 255 is currently reserved.

Only SAP 255 and 2 are reserved. All other SAPs are free and may be used by new application programs.

10.4.4 Length Field

The Application layer uses all or a part of the remaining bytes of the Exchange Area buffers that are not used by the Balluff AnyBus Protocol. The Length Field is introduced to keep the information of how many bytes are really used by the Application Layer. A fragment that is not the last one of a fragmentation sequence must fill this field with Max(In/Out)Bytes-3, depending on whether it is an INPUT/OUTPUT fragment. Otherwise this field is filled with a number that is less than or equal to Max(In/Out)Bytes-3.

10.4.5 Application Data Buffer

The Application data buffer holds the CBx commands described in the CBx Command Protocol Manual.

10.5 EXAMPLES OF PROFNET COMMAND/RESPONSE MECHANISM

As seen in par. 10.3, there are two buffers – an OUTPUT Buffer that is controlled by the MASTER, and an INPUT Buffer that is controlled by the slave (the Controller).

The **OUTPUT Buffer** is mapped the following way:

Output Buffer	
Byte #	
00:	OUTPUT BUFFER CONTROL BYTE (OBCB)
01:	(Always 0)
02:	Packet Length in Bytes
03:	Packet Bytes (Command)
04:	" "
05:	" "
06:	" "
07:	" "
08:	" "
09:	" "
10:	" "
-	" "
-	" "
N-2:	" "
N-1:	Data Consistency Byte (OBDCB)

Byte 0 is the **Output Buffer Control Byte**. The Master uses the lowest two bits of this byte for handshaking: to signal that a command is ready for the slave (**Bit 1**), and to acknowledge receiving a response from the slave (**Bit 0**).

OUTPUT BUFFER CONTROL BYTE							
7	6	5	4	3	2	1	0
[1]	[0]	[0]	[0]	[0]	**[0]**	**[0]**	**[0]**

Bit 0 is toggled by the Master to acknowledge a packet (response) from the RFID Controller.

Bit 1 is toggled by the Master when it has a packet (command) ready for the RFID Controller.

Bit 2 is set when the Master wishes to initiate a "Resynchronization" with the Slave, and then cleared when it sees the corresponding handshake from the Slave, (indicating that the resynchronization is complete).

Bit 3 is set by the Slave when the total CBx response being returned to the Master is larger than the space available in the Input Buffer (or that the packet being returned is a fragment, and that there are more fragments to follow). This bit is cleared for the final fragment of a fragmented response – and so the Master can know when all the fragments of a response have been returned from the Slave.

Bit 7 is always 1, to conform to Balluff's proprietary Protocol.

Byte 1: is always 0.

Byte 2: contains the length of the packet in bytes (CBx Command or Command Fragment) to be sent to the RFID Controller. This can be the length of an entire CBx command, or the length of a fragment of a command, if the CBx command is larger than the space allowed to send it in a single fragment.

Byte 3 through Byte N-2 are used for the actual CBx Command or Command Fragment to be sent.

Byte N-1: the final byte of the Output Buffer is the **Data Consistency Byte.** It is a copy of the **Ouptut Buffer Control Byte.** When changes to the Control Byte are made, the same changes must also be made in the Data Consistency Byte, before the changes "take effect". This is to guarantee the validity of the data between the two bytes.

The **INPUT Buffer** is controlled by the Slave (RFID Controller) and is mapped the same way, except for the packet bytes containing a response (or response fragment) from the controller.

Input Buffer	
Byte #	
00:	INPUT BUFFER CONTROL BYTE (IBCB)
01:	(Always 0)
02:	Packet Length in Bytes
03:	Packet Bytes (Response)
04:	" "
05:	" "
06:	" "
07:	" "
08:	" "
09:	" "
10:	" "
-	" "
-	" "
N-2:	" "
N-1:	Data Consistency Byte (IBDCB)

Byte 0 is the **Input Buffer Control Byte.** The Slave uses the lowest four bits of this byte for handshaking: to acknowledge receiving a command from the master (Bit 1), and to signal that a response is ready for the master (Bit 0).

INPUT BUFFER CONTROL BYTE							
7	6	5	4	3	2	1	0
[1]	[0]	[0]	[0]	**[0]**	**[0]**	**[0]**	**[0]**

Bit 0 is toggled by the Slave when it has a new packet (response or response fragment) ready for the Master.

Bit 1 is toggled by the Slave to acknowledge a packet (command or command fragment) from the Master.

Bit 2 is set by the Slave after it completes resynchronization, and then cleared once the Master has acknowledged that resynchronization is complete.

Bit 3 is set by the Slave when the total CBx response being returned to the Master is larger than the space available in the Input Buffer (or that the packet being returned is a fragment, and that there are more fragments to follow). This bit is cleared for the final fragment of a fragmented response – and so the Master can know when all the fragments of a response have been returned from the Slave.

Bit 7 is set to 1 as soon as the Slave has been successfully initialized at power-up, and remains at 1, to conform to Balluff's proprietary Protocol.

Byte 1: is always 0.

Byte 2: contains the length of the packet in bytes (CBx response or response fragment) to be sent back to the Master.

Byte 3 through Byte N-2 are used for the actual CBx response or response fragment to be sent.

Byte N-1: The final byte of the Input Buffer is the Data Consistency Byte for the Input Buffer. It is a copy of the Input Buffer Control Byte. The Master should check that these two bytes are the same, before considering the Input Buffer's data to be valid.

NOTE

The combined total of the input and output buffers cannot exceed 248 bytes.

For specific exchange data examples, refer to the examples in par. 9.5, Profibus Interface.

11 TECHNICAL FEATURES

11.1 BIS M-62_ PROCESSOR UNITS

ELECTRICAL FEATURES	
Supply Voltage	12 to 30 Vdc
DC Input Current max.	500 to 300 mA
Host Communication Interface:	
RS232	RS232
RS485	Subnet16™ (RS485)
IND	Ethernet IP, TCP/IP, MODBUS TCP
DNT	DeviceNet 125
PBS	Profibus –DP
PNT	Profinet IO
Digital Input (-12 models)	One optocoupled polarity insensitive digital input
Voltage Range	6 to 30 Vdc
DC Input Current max.	28 mA
Digital Outputs (-12 models)	Two optocoupled digital outputs
Voltage Range	6 to 30 Vdc
DC Output Current max.	external power: 500 mA per output; processor units power: 300 mA total for both outputs
RADIO FEATURES	
Frequency	13.56 MHz
Air Protocols	ISO 14443A, ISO 15693
Conducted Output Power	1 W
ENVIRONMENTAL FEATURES	
Operating Temperature	-20° to +50 °C (-4° to +122 °F)
Storage Temperature	-20° to +70 °C (-4° to +158 °F)
Humidity max.	90% non condensing
Protection Class EN 60529	IP65
PHYSICAL FEATURES	
Dimensions:	
RS232, RS485, IND	137 x 112 x 48 mm (5.40 x 4.41 x 1.88 in)
DNT, PBS, PNT	164 x 112 x 48 mm (6.48 x 4.41 x 1.88 in)
Weight:	
RS232, RS485, IND	440 g (15.5 oz)
DNT, PBS, PNT	560 g (19.8 oz)
USER INTERFACE	
LED Indicators:	
RS232	READY, RF, COM
RS485	READY, RF, COM, NODE ID
IND	READY, RF, COM, DEFAULT IP, CUSTOM IP
DNT	READY, RF, COM, DEVICENET
PBS	READY, RF, COM, STATUS, OP MODE
PNT	READY, RF, COM, NET STATUS, MODE STATUS, LINK 1; LINK 2

The features given are typical at a 25 °C ambient temperature (if not otherwise indicated).

11.2 BIS M-37_ ANTENNAS

RADIO FEATURES	
Frequency	13.56 MHz
Input Impedance	50 ohms
Gain:	
BIS M-370-000-A02	-37.8 dBi
BIS M-371-000-A01	-36.6 dBi
BIS M-372-000-A01	-26.3 dBi
BIS M-373-000-A01	-22.9 dBi
Conducted Input Power	1 W
ENVIRONMENTAL FEATURES	
Operating Temperature	-20° to +50 °C (-4° to +122 °F)
Storage Temperature	-20° to +70 °C (-4° to +158 °F)
Humidity max.	90% non condensing
Protection Class EN 60529	IP65 (when correctly mounted)
PHYSICAL FEATURES	
BIS M-370-000-A02	
Dimensions	70 x 500 x 40 mm (2.76 x 19.69 x 1.57 in)
Weight	635 g (22.4 oz)
BIS M-371-000-A01	
Dimensions	100 x 100 x 42 mm (3.94 x 3.94 x 1.67 in)
Weight	280 g (9.88 oz)
BIS M-372-000-A01	
Dimensions	200 x 200 x 42 mm (7.87 x 7.87 x 1.67 in)
Weight	500 g (17.64 oz)
BIS M-373-000-A01	
Dimensions	300 x 300 x 42 mm (11.81 x 11.81 x 1.67 in)
Weight	740 g (26.10 oz)

The BIS M-62_ Processor units and its antenna are intended for indoor use only.

www.balluff.com

Balluff GmbH
Schurwaldstraße 9
73765 Neuhausen a.d.F.
Germany
Phone +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.de
www.balluff.com

Nr. 896 712 E · Edition 1307; Subject to modification.